AGRITECTURE: WOVEN LEA FARM

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

This thesis is a design of a sustainable family farm within the context of drastic changes is rural areas over the past century and the coming changes of the future century. The design explores the integration of farm culture, farm architecture, and farm sustainability. It uses the creative architecture to solve common farm problems.

The thesis is organized into three major chapters relating to the three major areas of research; architecture precidents, context, and farming approahes, along with a design chapter.

Chapter one looks at precedents for the unusual proposition of an architect designing a farm which is usually left to vernacular architecture. The farm design is related to the evolution of the villa ideology using James Ackerman.

Chapter two explores the context of agriculture. It maps the historical changes due to industrialization and cheap fossil fuel energy. It continues to map the current beginnings of change due to rising energy costs and environmental concerns. These issues are expressed in the local conditions of the 150 acre site in Middlesex County, Southern Ontario. It places the thesis within contemporary issues of sustainability.

Chapter three explains the design of the Woven Lea Farm. It describes the architecture of the farm as a total ecosystem design. The woven Lea Farm gets its name from the many complexities woven together and the pasture or lea rotation system which is an essential part of the design.

Chapter four explores agriculture approaches and resulting technologies. It is a critique of artisanal, industrial, certified organic, and organic practices. This chapter explains the design as a hybridization of all these theories and explains many of the processes involved in the Woven Lea Farm.

The design presents the agriculture environment and a critique of available practices. The design is a holistic approach including energy cycles, animal and landscape management, and passive building systems. This thesis is not only a design solution but can be used as a reference for many potential practices and creative problem solving methodologies available to farmers.

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DEDICATION

Since I cannot cite my Dad in the Bibliography I will thank him here for his extensive knowledge base and insight through this design.

Thanks Mom for instilling in me great ambition (perhaps too much).

Thank you Craig for your patience, help, and your artwork.

Thank you Sue for your encouragement and many long discussions.

C O N T E N T S

LIST OF ILLUSTRATIONS

PREFACE

As I gathered up the belongings that would make up my home for the next eight months at the University of Waterloo's School of Architecture, I wondered whether I had made the right choice when choosing architecture over agriculture. There was a part of me, deep down, that worried as many farmers do, about the loss of the family's farm. I was the only child out of four that had any interest in farming at that time. I worried that if I didn't take over, my childhood home and my memories would be lost.

I remember driving the tractor with my dad and him teaching me how to operate the disc plow to work the land just right.

I remember playing hide and go seek in the baled hay field with my brothers and sister as dad collected the bales from the field and brought them home to the farm, with us sitting on the back of the wagon watching the road pass quickly beneath our feet hanging off the edge of the wagon.

I remember picking the prettiest baby calf from the pen and training the stubborn heifer to walk on the halter for the dairy show.

I remember the late nights and watching the single light which represented dad's tractor driving through the field.

I remember eating the strawberries instead of picking them and pulling weeds with my mom.

I remember mom spending many hours in the office managing the farm books and having discussions with dad about whether he could buy a new tractor rather than renovate the house.

I remember going to town in my smelly barn clothes because there was *no time to change and wondering what people thought about me. Did they understand why I was smelly and did they know that we provided food for them, or did they just plug their noses?*

These images are essential to my character, and like many others, I feel a longing for the traditional life of farming. "It was not of course an image born of the mind and the intellect but one born of the emotions. At that time I did not fully understand what it was that moved me so powerfully. […] All this closely related to the earth, the sky, to animals and growing plants and trees and my fellow men" (Bromfield 1956, 4). The countryside has a powerful image that pulls at heartstrings.

There is not only the loss of memories, but the loss of knowledge. Farmers pass on to their children techniques and values they have learned in farming over the years. If I didn't take on the role of farmer, who else was going to continue the legacy? Would the knowledge of farming disappear? Could farm life disappear? Would my children never know the joys and sorrows of hard work and country life?

At school I was unique. There were only three people in my class who had farming backgrounds. Although it did not come up often, when it did, people reacted with the look of amazement and awe. I'm not sure why they reacted this way. I told them about the farm and they seemed to understand, but I knew that they had no idea. Farming was hard work! However, I was definitely proud I was a farmer because there is something more to farming than just hard work. I just couldn't put my finger on it. This thesis is an attempt to define what is so special about farm culture and to help me resolve my decision of becoming an architect rather than a farmer.

After surviving my first year at university, I came to appreciate the work and the lifestyle associated with farming. I realized I missed the fresh air, the peace and quiet, the morning dew, the woodlot in the horizon, the brilliance of the colours, and the sound of the cows mooing as they waited to be fed. I missed the hard work and the satisfaction of the labour which provided food for the world. I missed stepping onto the porch first thing in the morning or on a sunny afternoon and just gazing over the fields my dad had planted. Farmers like my dad are the caretakers of the land. They are the architects of the countryside. Their choices shape the aesthetic, experience, duration, and health of our most valuable resource: land.

While at school, I learned about a world and culture that I had not known much of before starting university. Over the years, I slowly converted to a city girl and forgot about farming as co-op terms and travelling kept me away from home, until one day in my third year, my memory was jogged at a Chapters bookstore. As I was browsing, I came across an architecture book called 'Barns.' The old barns in this book were converted into houses by architects. I looked through the images and a sense of nostalgia came over me. The book was a combination of two things I loved: modern architecture and farming. I left the book there but it didn't leave my mind. I was also thinking of the dreaded thesis I was going to write in two years: what was I going to write about? It dawned on me that I needed to go back and buy that book. The book seemed to represent me in some way. It had the elements of an educated and styled architect in the shell of a simple down-to-earth farmer. Agriculture-architecture was going to be my thesis. My thesis was going to educate the cultured architecture community about the world of farming.

The thesis process taught me many things. It expanded my horizons beyond the techniques my dad uses on his farm. It challenged my vision of what a farm is, and encouraged me to think of what it could be. The research gave me a new appreciation of the many and complex tasks of a farmer and a farm. Most importantly, it taught me that I did not need to educate the architecture community, but to adjust my own ideals and that of my farm community.

I had left the farm to go to the city, but I came back. However, I did not come back the same ignorant girl of six years ago. I had a broader understanding of the world beyond the farm and a distinct disgust with the ‘country style’ of decorating. Perhaps there is a place for an architect like me in farm design.

INTRODUCTION

I

"Underlying all that I have achieved – such as it is – are my memories of my father's ranch, where I spent my childhood and adolescence. In my work I have always striven to adapt the magic of those remote nostalgic years to the needs of modern living." Emilio Ambaz

This design thesis is about the sustainable family farm. It involves an architecture designed to support the lifestyle of sustainable and integrated farming. The design, like a farmer, is one "whose sense of beauty and poetry is born of the earth" (Bromfield 1956, 8). It is not a thesis about the best and most up-to-date farming techniques, although many various techniques are explored beyond those of conventional practices. This design thesis cannot save the farming culture, but it does integrate some of the best qualities that a farm can generate for a lifestyle. This thesis is a particular way of looking at sustainability in farming. The design explores how an architect might integrate farm culture, farm architecture, and farm sustainability into a farmstead.

In order to design the farm, it is necessary to articulate what farming culture is and how it is different from urban culture. It is also necessary to establish a cultural context within which to design. Two approaches to defining farm culture emerged in the research. One was a poetic attempt at articulating rural life. The second was an attempt at measuring rural characteristics and statistics in order to map the changes within the historical context of agriculture.

Raymond Williams, along with Louis Bromfield, write beautiful prose explaining the culture of farms. Bromfield describes “the science of agriculture, which is the only profession in the world which encompasses all sciences and all the laws of the universe, but the realm of human philosophy as well” (Bromfield 1956, 7). Louis Bromfield lived within the political environment of Europe among and was longing for peace; he “wanted roots for the rest of [his] life” (Bromfield 1956, 1). The farm was a place for peace, simplicity and ideally, a fulfilling lifestyle. Williams states in the first chapter of his book, ‘The Country and the City,’ that he is preoccupied with the intense experience of the country and would not justify these feelings which prevail under all the writings in his book (Williams, 1973, 3). This thesis does not apologize for sentimentality, just as Williams did not apologize for the desire to live on a farm.

Alongside Williams and Bromfield, culture could be poetically defined through barn architecture. Eric Arthur and Dudley Whitney wrote ‘Barns: A Vanishing Landmark.’ They understood that the icon of farming society longed for was disappearing: “it is possible that millions now living in North America have never seen a barn, let alone been in one. In the foreseeable future there is more than a possibility that for many, the kind of barn illustrated in these pages will not be there to see” (Arthur and Whitney 1972, 11).

This was the starting point for one of the major struggles of this thesis: how do you deal with the nostalgia and sentimentality of the old farm's form. In his book 'Country and the City', Raymond Williams asked: "is it anything more than a well known habit of using the past the 'good-old-days' as a stick to beat the present?" (Williams, 1973, 12). One might then ask, why should this thesis refrain from completely supporting a reversion to the old barns of the past, since people seem to like them better? It is clear that Arthur and Whitney also understood that reversion was unacceptable when they wrote:

> we accept these new farm buildings as we must accept the inevitable, but we look forward to their evolution in matters of design and material to the point where a comparison may be made with the barns of an earlier era in which beauty and surprising degree of efficiency emerged as a solution to the basic problem of feeding, storage, and shelter (Arthur and Whitney 1972, 21).

This thesis must address that farming cannot any longer operate as it did in the days of the old worn barns, but that it must take the practices of contemporary architecture and evolve with them, making them as beautiful and efficient as in the past. It is not a goal of this thesis to design a new icon for farming, but it does carry the values that traditional farms represent for society.

The thesis does recognize the cultural changes that were occurring in rural Canada. Two pieces of writing were read which used the agricultural census data as a way of defining rural culture and the way it is changing and even disappearing. The two pieces of writing were entitled 'Rural Canada in Transition' and 'Rural Canada: Structure and Change.' They were written in 1966 and 1988, respectively. These books assessed how and why the rural situation had declined in the past.

> The technological development, especially in agriculture, as well as increased contact with industrial cities, movement of

> people from rural communities to urban centers, and spread of urban beliefs and values due to the improved means of transportation and communication have radically transformed rural Canada in recent decades. The transformation has been so dramatic, and urban influence so pervasive, not only in Canada but also in most industrial societies in the Western World, that some scholars have proclaimed the extinction of the rural society or at least of any meaningful distinction between urban and rural society (Dasgupta 1988, 18).

Many of the statistics presented in these books looked at the change in technology and how it related to the change in rural culture. Technology seemed to have a big effect on the depopulation and disappearance of rural Canada. The essence of these studies revolved around the disappearance of the family farm. Dasgupta writes:

> The family farm is highly idealized in North America for upholding three valued traditions: the tradition of man-land relationships, the tradition of democracy, and the tradition of efficiency in making the most of one's resources. The decline of the family-sized farm is viewed by many people, including some sociologists and agricultural economists, with great concern who believe that the institution should be maintained" (Dasgupta 1988, 91).

This author's feelings reflect that of past and present society alike: that the family farm was something unique, and needed to be preserved in some form. The factors affecting change, like technology and economics, are out of the hands of architecture. While this thesis cannot save rural culture, it does try to enhance some of the conditions required for the existence of a particular rural culture, of which the family farm is an essential component.

The research consulted looked at how urban influence infiltrates and how information and new practices are shared and spread through rural culture. A design in rural culture needs to know how to make a convincing argument for change within this farm culture, as Dasgupta suggests:

> Cultural factors have been found to be of great importance in studies on planned or guided social change. The beliefs, values, and customs of a group of people often act as barriers or stimulants to the sociocultural change. A new idea or practice may be rejected by a group of people if it is considered a threat to their established patterns. But if the practice is seen to be useful to satisfy their perceived need, and it is compatible with their existing customs and values, it will be accepted (Dasgupta 1988, 75).

If the thesis were a real design with real potential to be a family farm, it would need to fit into the context of contemporary agriculture approaches. The thesis design was tested with local farmers by presenting the project and getting feedback through an interview.

The research continued to look at changes and current issues experienced within the farm world, using the same methods as the two sources discussed above. This was done using census data to illustrate culture and change. The research for this thesis included statistics from the Canadian Agricultural Census to illustrate the way in which farming is in transition again. The issues agriculture currently faces include, energy concerns, unsustainable scales, land stewardship, environmental concerns, architecture and technology debates, and farm mechanization. As sustainable issues come to the forefront and energy prices rise, farmers will need to adapt. The transition could lead to the collapse of the food industry, as explained by Pfeiffer in 'Eating Fossil Fuels.' A sustainable future is also one where the practices of today do not threaten the opportunities of tomorrow. This includes environment, income, and culture. Chapter two of this thesis deals with these issues and lays out the numbers which address the contemporary challenges that rural Canada will need to address as well as those that architecture might be able to shed light on.

Can an architect design farms? What role is there for an architect in farm design? There are not many precedents of architects designing contemporary working farms; however, there are precedents in history in the form of the villa and the country home. Chapter one of the thesis looks at the architectural precedents for architects and farm design. Three major architects were looked at: Thomas Jefferson, Andrew Jackson Downing, and farmers themselves. James Ackerman is the author of the book entitled ‘The Villa.’ The book tracks the evolution of villa architecture from Roman times to the suburban villas of today, putting these architects into historical context.

A brief look at Andre Palladio showed that he designed farm villas during a period of history when wealthy families were moving to the country to escape the city in Renaissance times. The Renaissance needed an architect

> who would possess a skill rare in the Renaissance in designing functional and utilitarian structures for which there was no tradition in earlier architecture, but who would command classical heritage so as to land an air of cultivated grandeur to the country estate of gentlemen who still thought like city dwellers (Palladio and Burns 1975, 52).

Palladio’s work parallels this thesis. He held the characteristics and knowledge appropriate to the cultural shift just as this thesis needs to address the changes from fossil fuel-based farming to a sustainable farming.

Jefferson and Downing were architects who understood the culture of farming and designed architecture that upheld the morals and values of the farming culture. Downing writes during an age of extensive building in Midwest America. He also designed the catalogue houses of Sears, where a house could be ordered along with wood and supplies and shipped to a chosen location. Downing describes “the simple farm-house, rustically and tastefully adorned and ministering beauty to hearts that answer to the spirit of the beautiful, will weave a spell in the memory not easily forgotten (Downing, 1824-1892, 213). A genuine farmhouse can appeal to the hearts of society.

The final 'architect' that was looked at was the farmer, who instinctively knew how to design farms. In the book titled 'American Farm Buildings,' Donald Berg criticized the American style of farm building. He critiques Downing and compares his work to the designs produced by farmers and farmers' wives in order to discover what makes the old farms so beautiful:

> The character of the farm should be carried out as to express itself in everything which it contains. […] His structures of every kind should be plain, also, yet substantial, where substance is required. All these detract nothing from his respectability or his influence in the neighborhood, the town, the country, or the state. A farmer has quite as much business in the field or about his ordinary occupation with ragged garments, out at the elbows, and gownless hat, as he has to occupy a leaky, wind-broken, and dilapidated house. Neither is he nearer the mark, with a ruffled shirt, a fancy dress, or gloved hands when following his plough behind a pain of fancy horses, than in living in a finical, pretending house, such as we see stuck up in conspicuous places in many parts of the country (Berg 1997, 82).

The farmer's designs were true to the nature of the job and no compromises were made in terms of efficiency. All the precedents are practical and straight-forward designs trying to capture the essences of farming in architecture. Design decisions by farmers are based on needs and function, not aesthetics. Perhaps beauty is found in the usefulness of farm architecture. If this is true, then where does an architect concerned with aesthetics fit? Is there potential in these changing times for an architect who knows about sustainable building design and integrated system design to be beneficial to a farmer's operation?

Four approaches govern contemporary agriculture practices used by farmers. These approaches determine the form of the farm. They are artisanal, industrial, certified organic, and organic. The researcher had to learn how to farm in the best and most appropriate ways. Chapter four describes these approaches and explains the methods taken from them and how they applied to the Woven Lea Farm. Wendell Berry, a farmer and a scholar, gave an important viewpoint on agriculture, which would act as a guide to evaluating the various practices. He felt that

> as for farmers themselves, they have long ago lost control of their destiny. They are no longer 'independent farmers,' subscribing to that ancient and perhaps indispensible ideal, but are the agents of their creditors and the market. They are 'units of production' who, or which, must perform 'efficiently' – regardless of what they get out of it either as investors or human beings (Berry 1981, 115).

Berry argues that farmers have lost control of their land and their commitment to the land through industrialization. He writes in a down-to-earth way, applying practical solutions that real farmers would be likely to adopt. From these initial thoughts on farming from Berry, critical judgments were made on the four philosophies of farming and their associated practices. The design forms a hybrid of all these philosophies and techniques.

To learn how to farm using an artisanal approach, historical handbooks on farming were used. For example, one of the sources used was 'Traditional American Farming Techniques,' written by Frank D. Gardener and originally published in 1916. Another book in the series was 'Barns and Outbuildings' originally published in 1881. These books provided practical, simple solutions to many problems of feeding, shelter, planting, and storage. These two books were actual guides for farmers when originally published, and provided insight into the nature of traditional farming. Artisanal farming is generally no longer practiced; most farmers are unwilling to revert to the hard manual labour, no matter how energy efficient it might be.

Next, industrial farming had to be explored. Deborah Kay Fitzgerald explains the rise of the industrial farm in ‘Every Farm a Factory: The Industrial Ideal in American Agriculture.’ Fitzgerald identified “five components that characterized nearly every successful factory: large-scale production, specialized machines, standardization of processes and products, reliance on managerial (rather than artisanal) expertise, and a continued evocation of ‘efficiency’ as a production mandate” (Fitzgerald 2003, 23). She uses a non-judgmental approach to determine where current farming methods originated from. She makes it clear that industrialization has had numerous benefits, but some industrial practices have had negative effects on farming culture and the environment. Further information about common industrial practices was gathered from the Ontario Ministry of Food and Rural Affairs website. Numerous articles address specific techniques and how to apply them to your farm operation.

In response to sustainable issues in society, many farmers have moved into certified organic farming. The basic difference between conventional industrial farming and certified organic farming is a rejection of chemicals that are used in the production of crops and livestock. Certified organic farming has recently become very popular; so much so that the Canadian National Standards Board needed to draft the ‘Organic Productions Systems Standards,’ which stated what constituted certified organic foods. In ‘Omnivores Dilemma,’ Michael Pollan describes that the “whole foods” shopper feels that by buying organic he is “engaging in authentic experiences” and imaginatively enacting a “return to the utopian past with the positive aspects of modernity intact” (Pollan 2006, 137). Pollan suggests that certified organic is merely a marketing tool and not actually the best way to farm and maintain a healthy environment.

Joel Salatin and his Polyface farm in Virginia, USA is a example of an extremely successful alternative farmer. Salatin is a genuine organic farmer, since he practices alternative farming and applies these philosophies to all aspects of his life. Salatin calls on writers like Bill Mollison, Sir Albert Howard, and Andre Voisin for assistance with many of his farming practices. Howard and Voisin wrote against industrial farming in the 1950's and provided a view of farming very different to that of industrial farming. Basic principles set out by these writers include looking at "the methodologies of nature" (Mollison 1988, 45). Howard, a major proponent of the organic approach to farming, writes that "soil fertility must be the basis of any permanent system of agriculture" (Howard 1940, 22). Organic farming is strongly rooted in nature and it is a complex system relying on accurate information to manage and monitor the farm operation. The information and knowledge to operate a complex organic farm is extensive, fragmented, and often contradictory, making these operations difficult.

After learning about the guiding philosophies and practices for all of these farmers as well as assessing the advantages and disadvantages of their different farming approaches, each had to be held to the standards of a sustainable future. The definition of the sustainable farm emerges from all approaches to farming studied during the course of my research. The sustainable farm is not only environmentally sustainable, but it is culturally, energetically, and economically sustainable. Judging from the studies done on farm culture and architecture, it is essential that this thesis design address the current context of farming. In order to be a potential example of a working sustainable farm, the design needed to be reasonable for a current farmer to implement. Thus, functionality cannot be sacrificed in favour of aesthetics; the culture of industrial mentality and maintaining farmers' economic welfare cannot be ignored, and the issues of sustainable farming in the future must be a priority in the thesis. The Woven Lea Farm is one solution to the problem of sustainable farming.

After the definition of the sustainable farm was established, the design needed a few practical guides for planning a farm operation, including building design, landscape management, and animal life design. The Ontario Ministry of Food and Rural Affairs provided a complete reference on how to operate a farm, what the animals needed to eat, and what the crops needed in order to grow. The processes of the farm were explained in great detail on the ministry website by aid of many articles as well. This allowed the establishment of a program requirements list to be used for the design. Chapter three and four describes the design in more detail. To design the buildings on the farm, establish dimensions, elaborate on the program requirements, the 'Farm Builder's Handbook' by R. J. Lytle was an extensive resource. Dimensions of most common farm machinery, space requirements for animals, feed requirements and their space requirements, and manure and waste care processes were included in this book. This book was invaluable to the design and planning of the farm in this thesis. Alternative energy research was also needed. James D. Ritchie's book, 'Sourcebook for Farm Energy Alternatives,' provided numbers for many alternative energy sources.

As land and environment are essential for a farm, the site and its context was explored using mapping techniques and various sources. Environmental data came from the following sources: Ministry of Natural Resources Canada, Canadian Wind Atlas, Middlesex County Historical Atlas, 'Trees in Canada' by John Laird Farrar, and 'Grasses' by Lauren Brown. These sources provide the basic knowledge about the site as part of an ecosystem. They are necessary to designing a farm which relies on the ecosystem, of which it is a part of.

The success and design of the thesis is measured and evaluated using statistical energy data. David Pimentel has published many books which discuss and measure the energy required to grow crops and animals, and the efficiency of many different fuel sources. Two of his books were used: 'Handbook of Energy Utilization in Agriculture' and 'Food, Energy, and Society.' These two books allowed a comparison of the energy requirements of different crops and different methods of production. The analysis allowed a detailed breakdown of inputs and outputs necessary to find areas to reduce energy and find potential energy in waste products. Ritchie's book on alternative energy, combined with Pimentel's book on energy inputs for various agriculture systems, provided essential information to design the alternative energy source systems. From these two sources, the design's energy use success could be measured in comparison to conventional methods. The Woven Lea Farm does not require energy from the grid to operate, and only uses fossil fuels made from the grain crops grown.

THE WOVEN LEA FARM

This design is devoted to sustainability and good farming. Sustainability is a major issue in contemporary culture because of the energy crisis and environmental issues facing our world today. This design thesis is written in anticipation of the changing mindset and hopes to provide a new architectural model to suit it. The design also responds to other issues of sustainability often forgotten in many strategies, like economics, industrial standards, cultural vitality, moral, spiritual, and architectural sustainability. The design creates an environment where good farmers can operate contentedly. The Woven Lea Farm is one solution to the problem of sustainable farming. It is also a reference for various techniques, philosophies, and issues. Every farmer is different and an infinite number of solutions, variations and techniques could be derived from the research in this thesis.

The Woven Lea Farm will uphold all the values important to farming: morals, care for the land, and quality food production. The design encourages the rural community to be viable again. The design is a practical and reasonable solution to the issues farming is currently facing.

This farm design thesis is for the next generation of farmers. The client is a good farmer who subscribes to moral and ethical standards. A good farmer is innovative, a critical thinker, someone who looks for alternatives and monitors and evaluates current practices; it is someone who understands the business of farming, is honest, practical, educated; it is someone who feels responsible for the land, and who enjoys the labor of farming. This type of farmer is the beginning of the next generation of farmers.

The Woven Lea Farm is a combination of three 20 hectare (50 acre) lots combined to make a 61 hectare (150 acre) farm in north east Middlesex County. Michael Troughton, who writes on the vernacular landscapes of Ontario, calls Middlesex County "the agricultural heartland" of Ontario (Troughton 1993, 20). Located 15 kilometres north of London, this site is in the middle of farming culture in Ontario. There is still a strong agricultural community in this area committed to innovative farming. Southwestern Ontario has a diverse range of farming types, from grain crops only, to mixed livestock and grain, to unique livestock like emu or deer. The design thesis is meant to serve a diverse farm. It has 40 milking cows, 20 replacement heifers, 20 veal cattle, 300 finishing hogs grown each year, with 15 permanent sows, 200 laying hens, 21 hectares (52 acres) of pasture, 13 hectares (32 acres) of woodlot and orchards, 0.8 hectares (2 acres) of farmyard, and 27 hectares (64 acres) of grain crops. This diverse mix of crops and livestock create a complex ecosystem within the farm boundaries. The farm is owned and operated by a family, where all family members have a responsibility and are involved in helping run the farm.

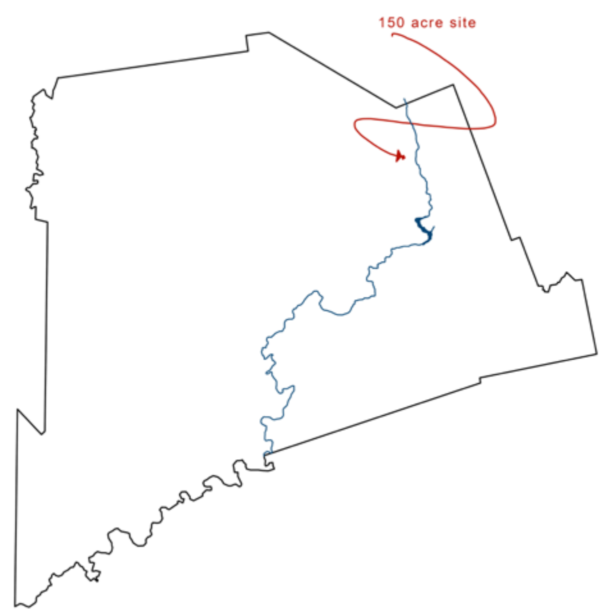


Fig1.1; The Woven Lea Farm is located in north-east Middlesex County.

A farm is like an ecosystem: the program is complex and all the variables relate to each other and must work together. The Woven Lea Farm is an integrated design. This approach considers all parts of a design and how they work together. Each part is an intrinsic part of the whole. The program was developed with both size requirements and relationship requirements to assist the design process. When all the components are combined, the result is a design which is dynamic and creative.

The architecture of this design will facilitate the activities of agriculture. Wherever possible, the architecture will do the farm work. The architecture of the barns facilitates the operations of storing hay and straw, watering animals, and ventilating barns. The machines do not control the architectural form, but contribute by being an essential element in the system. The house is also part of the farm system: the system of growing, gathering, and making food; the ritual of eating meals together; the ritual of coming in from the barns, and washing up; the ritual of resting at night and rising with the sun; the system of managing and watching over the farm; the system of relaxing in the evening. The house and barns are a "direct response to the daily physical and spiritual needs of their inhabitants" (Troughton 1993, 19).

Fig1.2; View towards the Sustinable Family Farm from the pastures.

AGRICULTURE ARCHITECTURE

II

Agriculture Architecture consists of farmhouses, villas, barns, and landscapes. Each are built for different purposes, but they all serve as shelter in the countryside. James Ackerman, in the book entitled 'The Villa,' describes the evolution of the villa from Etruscan times to that of his current generation of 1990. Ackerman describes the farmhouse as different from the villa. A farmhouse owner is a person who is required to work the land to make a living. Often, farm owners were derogatively referred to as peasants and were among the lowest social classes. The ancient Roman concept of the villa rustica depicts a villa that is self-sufficient in producing food for the owner and an income from the sale of the produce. In contrast, the villa urbana was built from income earned in the city (Ackerman 1990, 15). The villa rustica engaged the architecture and the owner in a productive relationship with the land. Most villa owners post the villa rustica model were upper class citizens who did not need to participate in the toiling of the soil to make a living. Although of different social classes, the villa and the farmhouse served similar purposes: production of food and provision of a home outside of the city.

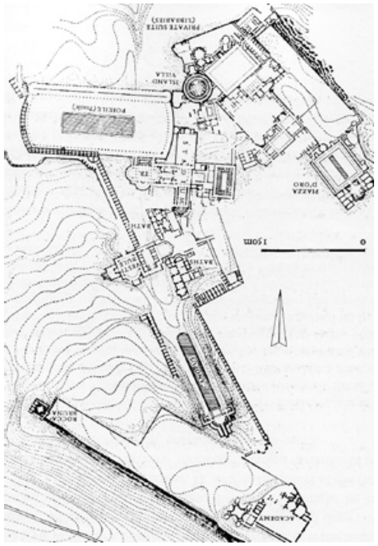


Fig2.1; Villa Hadriana in Italy is an expansive villa which works with the topography for form.

Fig2.2; Palladio's Villa Rotunda sits on a hill and overlooks all the land under ownership by the landlord.

Fig2.3; Monticello, designed by Thomas Jefferson, commands the views at the top of the hill and the agriculture operation surrounding it.

The villa and the farmhouse historically fell into separate architectural classes and their inhabitants were part of separate social classes. Ackerman describes the villa as a place where architecture was experimented with and thus, the villa became an example of the most up-to-date and innovative architecture. Villas such as Hadrian's Villa, Blenheim Palace, Villa Rotunda, and Villa Savoye display this characteristic in their time period. In contrast to this, Ackerman states that the evolution of the farmhouse is slow and often adapts to class-led, traditional forms. The traditional farmhouse is rarely held to be an example of leading architectural thought.

The contemporary villa is the house which benefits from country living and city amenities. Ackerman describe the suburbs of the city to be the contemporary version of the villa. However, there is not much country left in the suburbs for these 'villas' to enjoy. The contemporary farmhouse is no longer operated by a lower social class as it was in the past. Many farmers truly enjoy their labour on the farm and experience otium, or "an opportunity to engage, often intensely, in worthwhile physical and mental pursuits" (Ackerman 1990, 37), just as the villa owners Ackerman describes throughout history. The contemporary farmhouse has a much closer relationship to the traditional definition of villa rustica than do our contemporary suburban houses. The farmhouse truly provides a home in the countryside, an escape from the hectic city life and a productive relationship to the land. The farm can be re-invented with the dignity, style, and the innovation of a villa typology.

ACKERMAN AND CULTURAL IDEOLOGY

According to Ackerman, the ideology of the villa is deeply rooted in our culture. Our culture continues to desire an escape to nature. The earliest known villas of Etruscan and Roman times suggested unity between living in the country and being involved in agriculture. The early writings about villas and the country suggest that farmers were in the same ranks as painters and sculptors (Ackerman 1990, 35). Living and working in the country gave the inhabitants otium, and a sense of serenity or relaxation (Ackerman 1990, 37). Otium was only available at a villa, away from the city's anxieties. During the renaissance, the ideology diverged and the villa became solely a place of escape and not a place for agriculture. The villa became the opposite of living in the city. "The content of villa ideology is in the contrast of country and city, in that the virtues and delights of the one are presented as the antithesis of the vices and excesses of the other" (Ackerman 1990, 12). Although the villa ideology has evolved and diverged from agriculture over the centuries, the cultural phenomenon of the villa (country home) is deeply rooted in the collective ideology. Society continues to desire a peaceful place in nature that the villa can provide.

Fig2.4; This is a suburban villa designed by A.J. Downing in a picturesque landscape.

Fig2.5; Villa Savoye, in the suburbs of Paris, by Le Corbusier, shows the drastic evolution of the villa typology of its predescessors.

ARCHITECTS OF VILLAS AND FARMHOUSES

The architects Thomas Jefferson and Andrew Jackson Downing as well as farmers, play an important role in framing the culture of farm architecture.

THOMAS JEFFERSON

Although Thomas Jefferson failed in the business of farming, he succeeded in creating an American farm architecture and political environment which expressed the moral culture of America in the late 1700's and early 1800's. Jefferson wrote every morning about various topics concerning America, including politics, agriculture, and architecture. He was an innovative farmer, collecting best practices and state-of-the-art practices from around the world, including rice patties from Lombardy and threshing machines from Scotland. His farm at Monticello was a place for innovation in agriculture and architecture as he slowly built it and evolved it from 1796 to 1823 (McLaughlin 1988, 15).

Jefferson's architecture reflected his political goals of creating a natural farming American culture independent of Europe but tied to classicism. For Jefferson, "farming kept man honest, vigorous and independent" (Ackerman 1990, 206). Jefferson believed that climate (natural, political, economic, and social) shaped a culture. America had a very different environment than Europe. America was associated with nature, wilderness, and agriculture. American culture was about independent farmers. Farming was essential to the American culture of Jefferson's time. Monticello sits on a hilltop looking over the countryside to embrace the American landscape and take advantage of the view. Jefferson shaped his architecture and political goals to form a distinct American culture.

Jefferson, as in his agriculture, collected the 'best' solutions to architectural problems from all styles. Jefferson was influenced by Palladio, Roman monuments, and French architecture. Palladio's work informed Jefferson on proportions and the classical orders, but Jefferson later moved towards studying the Roman monuments directly. His bedroom designs included alcove beds, an idea taken from Parisian architecture. Jefferson also had many ideas of his own, which he rolled into his design at Monticello. Jefferson's use of the octagonal bay window, which allowed more light to enter into spaces, appeared in many American building styles later. The design of Monticello is an attempt to be practical in the arrangements of the rooms, but independent of pretentious colonial architecture to "find an architectural expression for the ideals of a new democracy" (Ackerman 1990, 200). It is designed in a classical language conveying moral strength with practical solutions like the slave quarters neatly arranged below the wings framing the lawn.

Fig2.6; Monticello was a place to experiment with architecture and agriculture. Jefferson had slaves to operate his farm, and contemporary farmers have tractors.

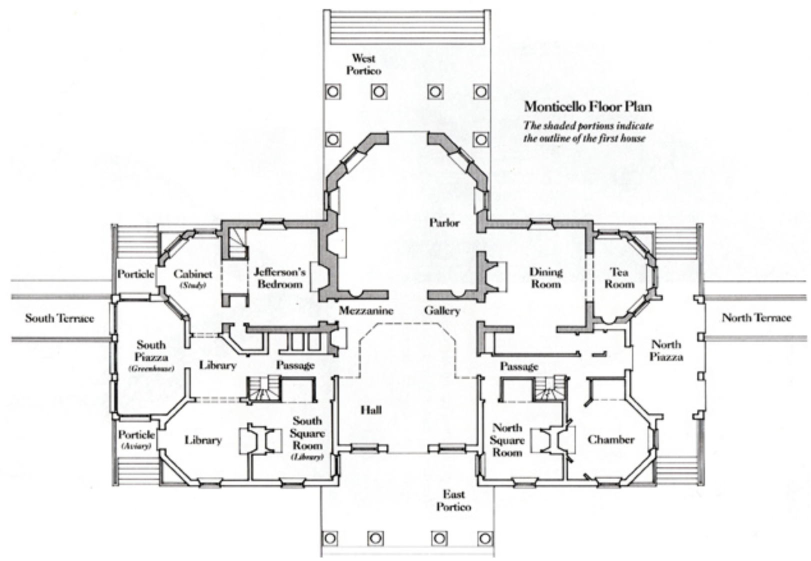


Fig2.7; Monticello's design is rooted in classical tradition seen through the symmetrical plan and classic column portico.

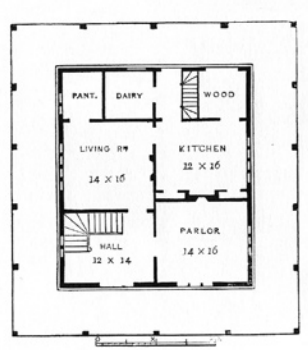
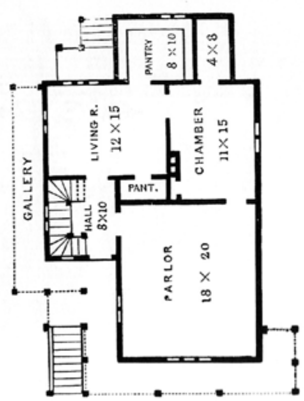


Fig2.8; Downing's design 15, entitled 'a farmhouse in the swiss manner.'

Fig2.9; Downing's design 10 entitled 'a swiss cottage.' Downing has done two farmhouses in the swiss style. The facades resonate with a Swiss aesthetic, but the plans are relatively indifferent to the swiss style.



ANDREW JACKSON DOWNING

A.J. Downing wrote and designed many statements about country building, including barns, farmhouses, and properties, following the picturesque period in Europe. He was among architects like Alexander Davis, creating the American romantic style and the catalogue home movements. The farmers of the mid-west were building new and bigger homes. Without a supply of wood in the mid-west, Sears and Mongomery Ward designed catalogue home plans which could be shipped along with the needed wood to a farmer's location.

Downing was particularly good at capturing in words the essences of farm culture and architecture. He understood that farmers were perceived as honest, straight-forward, frank, genuine, and open-hearted and thus, the architecture they lived and operated within should also convey this feeling. The architecture of Downing tries to capture the beautiful traits of the farmer's life and also provide for particular requirements of this lifestyle. Although he lacked knowledge of farm methods, he used vernacular precedents to fill this gap for typical solutions to common farming practices. His knowledge or stereotyped knowledge about farmers helped him write rules and goals for attractive farm architecture.

In 'Designs for Farmhouses,' Downing sets two goals for farmhouse architecture: beauty and usefulness. Beauty comes from four elements: form, proportions, details, and character. Form relates to its surroundings, which are usually flat; thus, a farmhouse should have breadth rather than height. The proportions of the house convey ampleness, solidarity, comfort, domestications, and simplicity. The details of the farmhouse create rustication and a picturesque look. Character comes from verandas, bay windows, and personal needs, which described a refined utility (Downing, 1824-1892, 12-19). Downing created a language for architecture in the context of agriculture.

Usefulness was the second goal. There are many characteristics which describe a farmhouse as useful. These include strong and enduring materials such as stone and timber, and materials which are abundant on the farm. The roof on a farmhouse should be steep to shed snow and disperse the hot air rising in the house. A farmhouse should contain practical rooms like a milk house, wood house, backroom, and pantry. The living room is for the whole family and should be large and comfortable. There are many other signs of a useful house, like a chimney and fireplace, which Downing explores in detail in other chapters (Downing 1824-1892, 12-19). Downing understood that a farmhouse must function in order to be beautiful and that the elements which are functional can also be beautiful. Downing captures some fundamental characteristics of farm architecture that can be applied in a variety of forms, as illustrated in his book.

Downing represented a suburban middle class and hoped to develop an American picturesque. As Downing wished, he had a major influence on American home styles. Each of his homes is presented in a picturesque image and Downing thought that “good taste could elevate the moral fiber of the nation” (Ackerman 1990, 244). He was practical and straight-forward in his cost estimates and technical details; however, his plans were never dimensioned and the facades never had any relationship to the particular plan they were associated with. Downing was not necessarily a good designer but he appealed to the cultural desires of the middle class farmers who were building bigger homes at the time.

Various farmhouse designs by Downing.

Fig2.10; ‘Bracketed American Farmhouse’

Fig2.11; ‘Braketed Farmhouse of Wood’

Fig2.12; ‘Villa Farmhouse’

Fig2.13; ‘Farmhouse in the English Rural Style’

Fig2.14; ‘Northern Farm House’

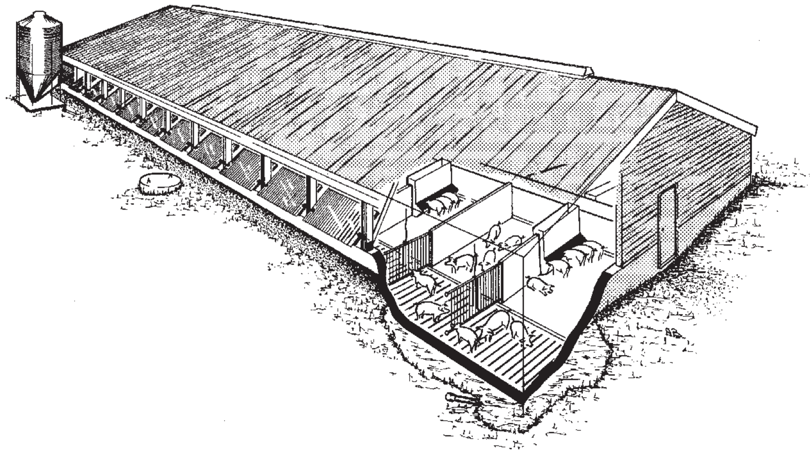
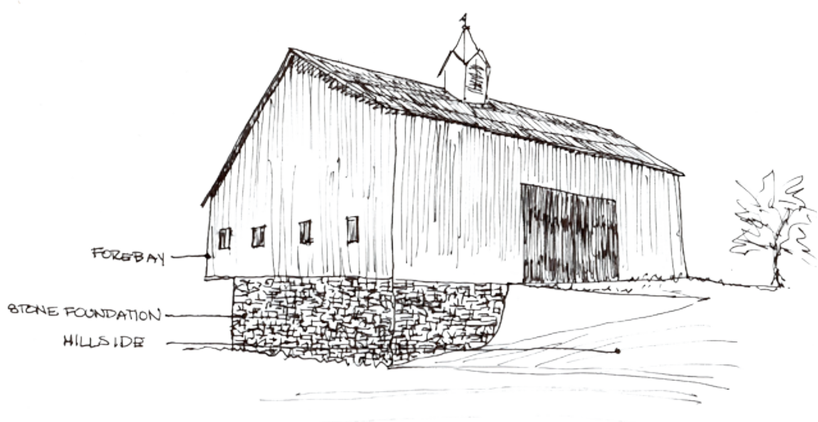


Fig2.15; A contemporary vernacular pig barn.

Fig2.16; The historical bank barn common in Middlesex County and much of South-western Ontario.



FARMERS AS DESIGNERS

Farmers create some of the best examples of practical agriculture architecture. They live and design their spaces around the methods, problems and constraints of their existence. Instinctively, farmers manifest contemporary culture in the things they build. They often know better about how they want their operation to work. When you take farmers out of the design picture, an important design opinion is lost.

Contemporary farm architecture is not designed by farmers but by engineers who understand functionality instead of culture, personality, or style. A similar dilemma was faced by farmers with the designs of Downing, discussed in journals such as 'The Horticulturalist' and 'The Cultivator.' Farmers "would have seen architects' plans in reviews in 'The Cultivator.' [The farmer] would have known more about home design than most architects cared to learn about potato farming" (Berg 1997, 22). Downing was selling style. Engineers know system designs but not how to satisfy individual farmers' needs and personalities.

Farmers are readers; most farmers in the mid-19th century were well educated about modern techniques of farming and architecture. Both these subjects appeared side by side in the journals and many articles were published about how to design barns and farmstead plans. The bank barn was first published in 1870 in 'The American Agriculture.' The bank barn was built into a natural or artificial hill; this allowed machinery with grain to access the second floor storage area and allowed animals to live in the cool basement. The barn was not decorated but "pleasantly designed" (Berg 1997, 85). The articles encouraged farmers to plan ahead with their designs so that their farmstead did not become chaotic. The site plan designs followed similar rules. A farmstead should be neat and orderly. The site should be organized on a grid for flexibility and easy cultivation and should also have natural plantings and orderly gardens spanning the entire yard . The farmer understood basic sustainability principles such as the house having southern exposure and being protected from cold northern winds. However, each farmer interpreted these suggestions differently and thus each property was different, having this simple strategy result in many variations. Farmers' personal tastes created a beautiful vernacular for their particular areas and culture.

Farming and the villa are part of a complex ideology embedded within contemporary culture. It is an intangible quality that emerges in the architecture. The ideals of farming are essential for appropriate architecture, but are difficult to capture. These ideals have been captured in many forms, as illustrated by Jefferson, Downing, and farmers. These are important visions of agriculture. Any contemporary design must still take into account these values when creating designs for agriculture. Since values change in agriculture, farm ideology can and will lead to many innovative architectural expressions. With new technologies and trends, the farmhouse can act as example for innovative architecture; it can become the contemporary version of the villa.

Various farmers barn designs from various places and different farmer's yielded many different barns and styles.

Fig2.17; Mr. Kyle's Barn, Ohio

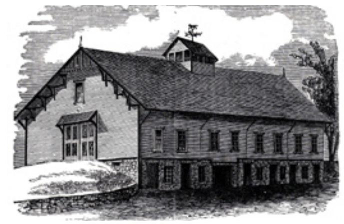


Fig2.18; Mr. Lawson Valentine's Barn, New York

Fig2.19; Mr. David Lyman's Barn, Connecticut

Fig2.20; Mr. Wm. B. Collier's Barn, Missouri

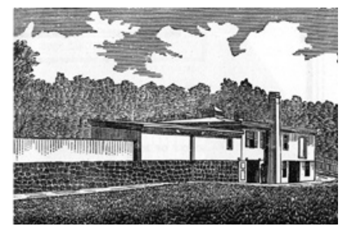


Fig2.21; Mr. Charles S. Sargent's Barn

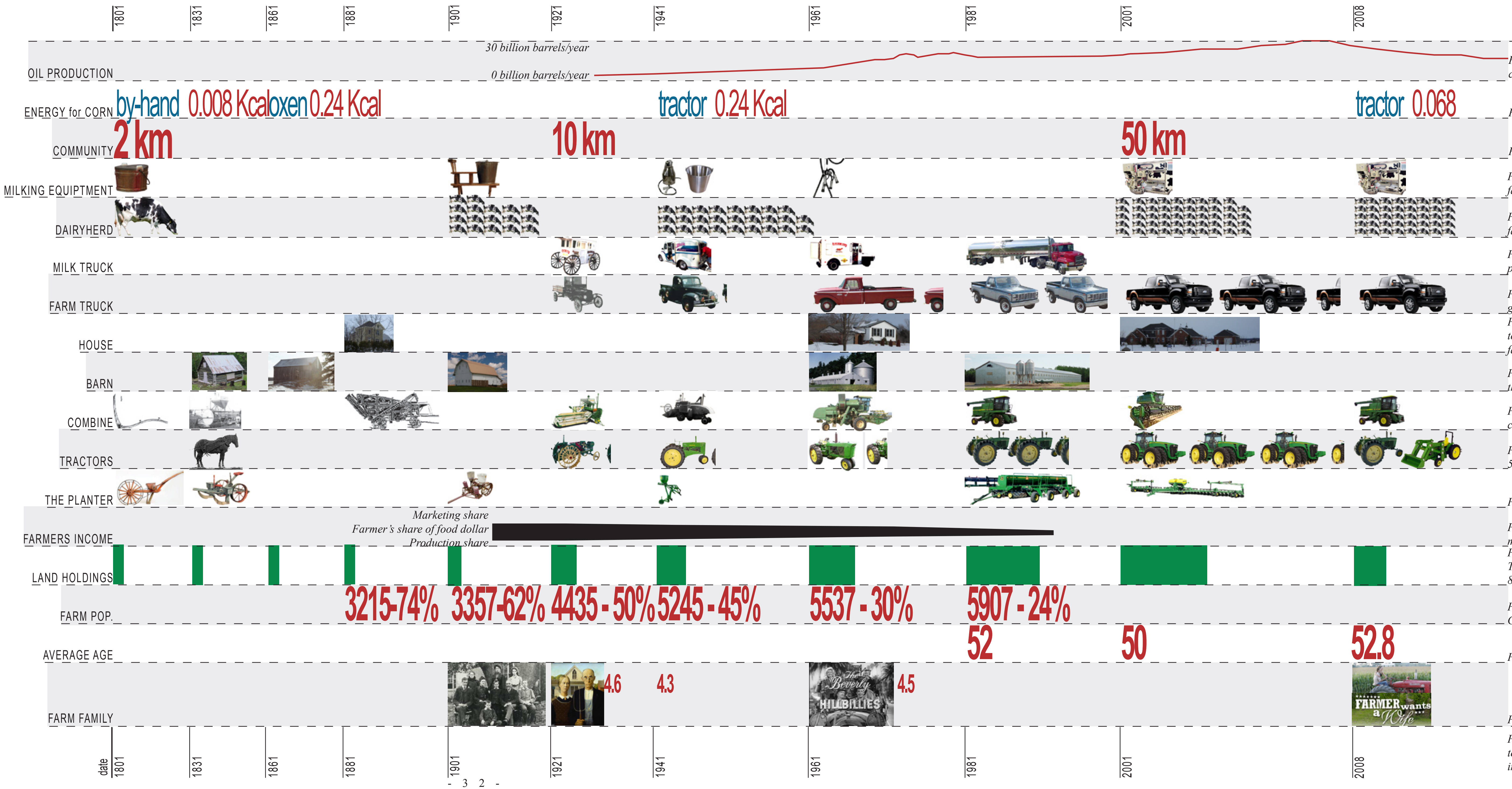


Fig3.1.1; The amount of oil production has reached a peak according to many analysts. This means energy prices will continue to rise as oil becomes more scarce.

Fig3.1.2; This number is the number of kilo-calories put into the crop in order to harvest one kilo-calorie of yield.

Fig3.1.3; The community radius around the farmer has increased with his ability to travel greater distances.

Fig3.1.4; Increasing efficiency in milking machines have allowed the farmer to physically milk more dairy cows on his farm.

Fig3.1.5; One dairy cow in 1801 provided the family with milk. The current herd supplies strangers, and many dairy farmers do not even drink their own milk, but purchase it from the store.

Fig3.1.6; The milk truck in 1921 carried glass bottles to people's homes, and the current trucks take milk to the processing plants before going to the store and the consumer.

Fig3.1.7; The farm truck is an essential part of rural life whether it is going for a sunday drive, picking up feed, or going to church.

Fig3.1.8; In the 1800's farmer's had more disposable income and they began building the brick houses that are common to most rural areas. Contemporary farmers are building suburban type homes or building additions onto the old farmhouses.

Fig3.1.9; The vernacular barn architecture is always about practicality. The vernacular techniques are inherited from the generation before and are added or refined by the next generation.

Fig3.1.10; The combine began as a stand alone machine powered by a motor. It has evolved to a self-propelled, and collection bin for efficient harvesting, and no wasted time.

Fig3.1.11; The amount of tractors per farm has grown over the years. The horsepower of these tractors has increased to 530 horsepower with the new John Deere tractor Model 9230.

Fig3.1.12; The corn planter slowly gets larger from a one-row planter to a 36-row planter.

Fig3.1.13; The farmers share of the fixed consumer food income has slowly been conceeding to production costs and marketing boards. The farmer's share of the income has been reduced to less than 20%.

Fig3.1.14; Land holdings by individual farms have increased from 20.2 hectares (50 acres) to 294.6 hectares (728acres). The total farmed land in Canada over the past 20 years has remained consistent around 67, 744, 719 hectares (167 400 846 acres).

Fig3.1.15; Although total farm populationhas not changed considerably over the years, the percentage of the total Canadian population tells us that one farmer feeds many urban citizens.

Fig3.1.16; Average age data is limited, showing that is has only become a major concern in recent census.

Fig3.1.17; The farm family although difficult to define can be described using family size and pop-culture stereotypes.

Fig3.1; The change from solar powered farming to fossil fueled farming has had dramatic effects on farm culture, technology, and communities. The current environmental and energy issues will stir more dramatic changes in farming in the future.

- 3 2 -

AGRICULTURE CONTEXT TODAY

III

Food = Energy + Nutrients. Food is produced by the agricultural industry, where energy and nutrients are put into the land to produce food. Agriculture takes energy from the sun, fossil fuels, and manual labour and receives in return plants and animals containing essential nutrients and calories needed to sustain human life. Agriculture is a means of harvesting the sun's energy; after all, it has done so for about 10,000 years (Pfeiffer 2006, 5). In the past 100 years, fossil fuels, in the form of diesel and fertilizers, are being harvested by plants in conjunction with solar energy. Before the industrial revolution, agriculture was done using 100% solar power. Currently, more than 90% of the energy harvested in agriculture is derived from fossil fuels (Pfeiffer 2006, 20).

Fossil fuels and technology set in motion dramatic changes to agriculture. The timeline in figure 3.1 provides the physical, cultural, and historical context for agriculture. It shows how fossil fuels have changed agriculture and how rising energy costs will change it again. The change of scale is dramatic over 200 years. Fossil fuels allowed every aspect of farming to grow. Land holdings by a single farmer have increased 12 fold, herd sizes per farm have increased 50 fold, and field machinery power has increased by a factor of 500 over the past 200 years. The need to conform to these scales threatens the culture of farming. This large scale has become an underlying issue, along with energy, for many of the problems encountered in agriculture today. Scale will continue to affect the industry as energy costs rise. Oil production has peaked recently and availability will continue to decline (Heinberg 2005, 2). As energy prices rise, there will be another major cultural shift in agriculture from industrial farming to sustainable farming. Every place where farming takes place has been affected by industrialization and will be affected by energy and environmental concerns.

The timeline begins to hint at many of the issues that will govern agriculture in the future. These issues are key design issues as well. Energy, community, land stewardship, ecology and environment, architecture, mechanization, economics and agribusiness, urban sprawl, aging farm population, and consumerism are the issues the design must work within and develop solutions for. These issues will affect all areas where farming takes place. Middlesex County, located in southwestern Ontario, is sometimes considered “the agricultural heartland of Ontario” (Troughton 1993, 20). The issues addressed on a general level within the timeline are applied to the site context of Middlesex County in the following sections in order to provide a historical, physical, and cultural context for the design.

ENERGY

Agriculture has pushed the limits of fossil fuels, land, and water (Pfeiffer 2006, 39). Pfeiffer's work and many other studies have shown that oil production will decline over the next 50 years. This will eliminate our source of cheap energy and oil prices will skyrocket. Following high oil prices will be high food prices. Our demand for oil will be higher than our capacity to produce it.

Ontario farm types are diverse; thus, energy uses are also diverse. Canadian agriculture accounts for only 10% of the greenhouse gas emissions (Ministry of Industry 2004, 129). Ontario agriculture uses 28% of its energy on heating and lighting of agricultural barns, more than the Canadian average of 17% (Khakbazan 2000, 1). This suggests that Ontario has a large amount of livestock and a lack of passive building design in barns. Livestock occupy buildings, which falls into the expertise of architects.

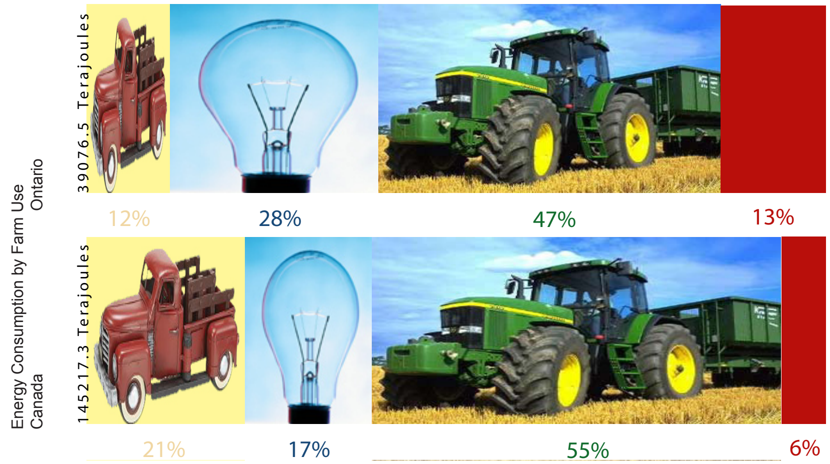


Fig3.2; Ontario uses most of the energy used in farming for tractors. However, higher than the national average is heating and lighting for buildings.

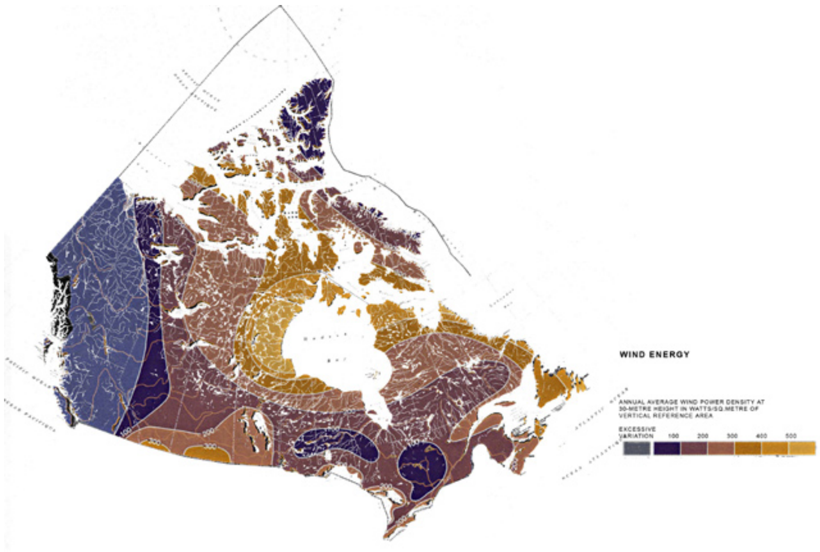
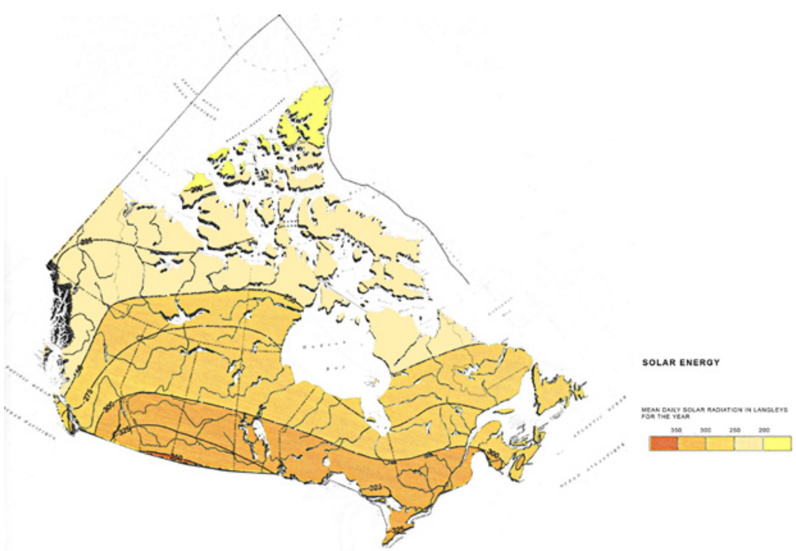


Fig3.3; There is average potential energy from wind in Ontario.

Fig3.4; The solar energy potential in Ontario is high compared to the majority of Canada.



Although agriculture in Ontario is using large amounts of fossil fuel energy, Ontario also has many alternative sustainable sources of energy to tap into. Many areas of Ontario have acceptable levels of wind energy to harness, and Ontario is a preferable location for harnessing high solar energy. This can be done technically with wind turbines or by design with passive building systems.

Farming has potential energy sources built into the operation by either reduction or maximization. It is necessary to use the energy already have available most effectively. Therefore, the common crops grown in Ontario were analyzed for energy inputs and outputs. Energy inputs to these crops include sun, nutrients (usually chemical fertilizers made from fossil fuels), water from the water table and aquifers, human energy, land area, electricity, and diesel. Inputs like chemical fertilizers can be reduced or eliminated if green fertilizers are used instead. Rather than taking water from aquifers or the water table, water collection could irrigate fields instead. Energy outputs are edible calories, protein, and waste products. Waste can be described as a by-product of a crop which is generally considered useless and is thrown away. These wastes can be used as insulation, heat, burning fuel, green fertilizers, or saleable products. An example is the waste heat generated from dairy manure: it can be used to heat a barn or generate electricity in the methane digester. Also, the heat generated in a compost pile has large potential for heating other areas of the farm, such as the house. Hay and straw storage from alfalfa and wheat can act as a wind barrier and insulation for barns where the hay and straw is needed. Soybeans can be pressed to produce biodiesel for the tractors while the by-product, meal, can be mixed with other grain and fed to the animals. The farmers of Ontario have a large potential for reducing their energy uses in order to become more sustainable, innovative, and cost-efficient. This thesis tries to capitalize on the way these waste products can be exploited to increase energy efficiency.

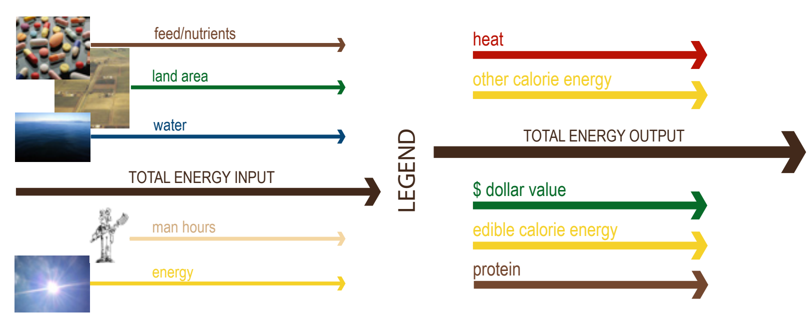


Fig3.5; The energy inputs and outputs allow the different crops to be truly compared and advantages to all are found. Alfalfa is the most efficient plant to be grown using conventional methods. Although humans cannot digest this plant, it can provide insulation value, or compost value. Corn is the next most efficient plant, and it is the second highest energy input needed for growing. Dairy is the third most efficient crop examined. It also brings the highest protein and dollar value of these four crops. Dairy also has a large amount of potential waste products, including manure and heat. For more crop analysis see Appendix 1.

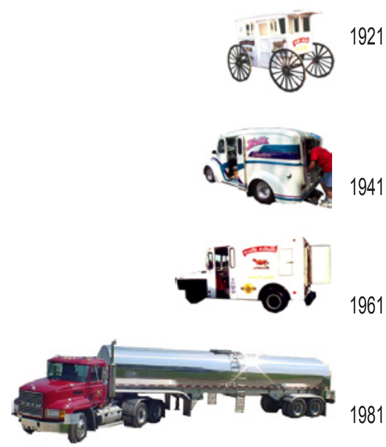
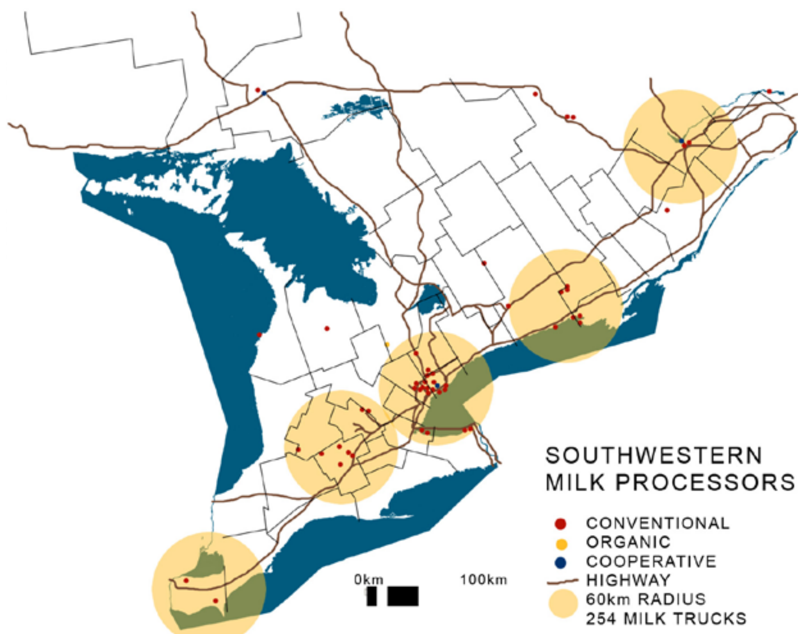


Fig3.6; Milk is moved around the province by the 'milk trucks' making pick-ups and deliveries. The 1821 milk truck carried milk bottles to town and the consumer's door. The 1981 truck carries many litres of raw milk to the processing plant and a different truck takes milk cartons and bags to the grocery stores where the consumer can pick them up. The consumer has no reference to the farmer who milked his cows for the milk.

Fig3.7; The scale of the milk production system in Southwestern Ontario is very large. Only 67 production plants process all the raw milk and is delivered by 254 milk trucks to all the grocery stores in Southwestern Ontario.



COMMUNITY SCALE

The change of scale of the agriculture industry has had adverse effects on farm community. The food community or food industry has dramatically grown due to fossil fuels. The milk processing plants have become larger and are spread farther apart. The majority of the 67 milk processing plants in Ontario are run by larger international companies, such as Nestle, Kraft, and Parmalot (DFO). These large companies have pushed out all the small milk processing plants, increasing the distance between the farmer and the processing plant. The image below shows the average radius around a processing plant to be 60 kilometres before it reaches another plant's area. However, this does not even cover all of Ontario. The energy requirements for this system are enormous and unsustainable. There are 254 milk trucks in Ontario delivering two full trucks of milk per day to a plant which is 60 kilometres away. This equates to 240 kilometres in food miles for unprocessed milk. This does not include the distance the pasteurized milk must travel back to a grocery store and then the kilometres a consumer must drive to purchase the milk. In the US in 1997, 1,790,000 food trucks consumed 20.294 billion gallons of fuel (Pfeiffer 2006, 24). As oil becomes scarce, this large-scale system will not survive.

Farmers have needed to conform in scale with the growing demand to maintain an economically viable farm operation. Many farm operations have disappeared throughout this process of expansion. The change in scale affects the farming community. Before this growth, the farmer had direct contact with customers who bought milk. The farmer built relationships with them and cared about his product, as his customers were his neighbours. Due to increased transportation, rural outmigration, and commercialization of farming, "the rural neighborhood is now a community of symbolic identity and affective relationships rather than an entity satisfying the functional needs of its residents"

(Dasgupta 1988, 130). The rural community does not actually provide food to its members. Consumers cannot actually relate to the farmer who produces their food, since they are so far away. The current system separates the farmer from the consumer community.

The social ecosystem of Middlesex County agriculture consists of many parties; the farmer, the farmer's family, the feed mill, the church, the school, and others. Farmers have needed to grow in scale with the growing demand to maintain an economically viable farm operation. Many farm operations have disappeared through this process of expansion and this has thinned out the agricultural community of Middlesex County. The community change of scale from 1830 to 2008 is dramatic. In 1830, the radius of a church, school house, and community was 2kilometres. This century has seen the disappearance of approximately 50% of the churches and 80% of the schools. The agricultural communities are being forced into the cities, where there is more infrastructure and services. The agricultural community is being stretched to a scale which threatens the unique rural culture and ties that bind it together.

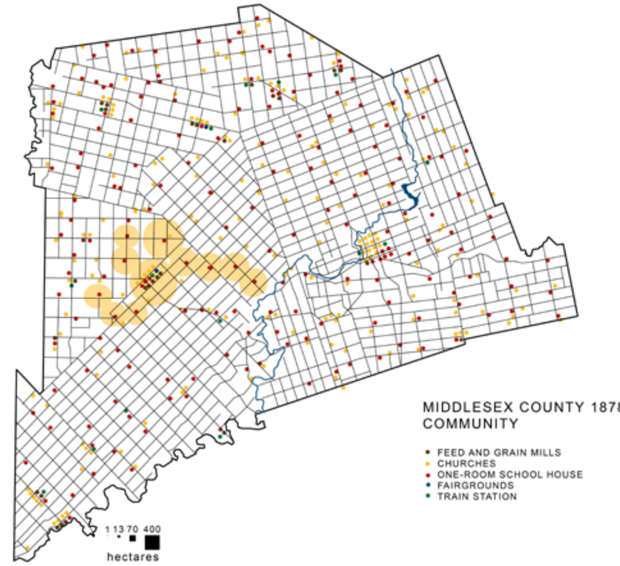


Fig3.8; A farmer's community is made by the feed mill, friends, family, neighbors, church, and the children's school. The average farmer's community in 1878 was contained in a circle with a 2kilometre radius.

Fig3.9; The contemporary farmer's community is defined by a larger circle and often larger than described here, because of the ability to move long distances easily.

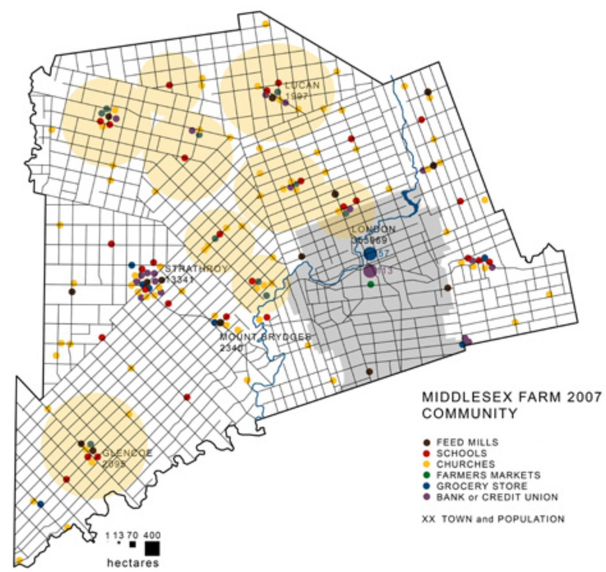


Fig3.10; Crop rotation is a common practice in Middlesex County. Other practices are slowly growing in popularity as farmers see their neighbors benifit from them.

LAND STEWARDSHIP

We have cultivated and occupied all the land on earth that has reasonable potential for farming; every year, 10 million hectares of land are abandoned because they are no longer fertile (Pfeiffer 2006, 6). Thus, what is occupied must be taken care of. Farmers often view themselves as stewards of the land (Bunce & Maurer 2005, 20) and most believe they are doing a good job. The land stewardship practices of farmers are varied and diverse. The farmers of Middlesex County are knowledgeable about some of the major conventional soil stewardship methods. Eighty-one percent of the farmers use crop rotations, 15% of farmers use rotational grazing (this number is slightly deceiving, as not all farmers use grazing pastures), 38% of farmers use windbreaks, and 52% of farmers use no-till cultivation to reduce soil erosion. “A good farmer is a craftsman of the highest order, a kind of artist. It is the good work of good farmers - nothing else - that assures a sufficiency of food over the long term” (Berry 1981, 124).

The relationship between the farmer and the land has changed over time. This relationship can be defined by the tools used In Canada, the average farmer is responsible for 294.6 hectares (728 acres) of farmland up from the 20.2 hectares (50 acres) of 1881(Census Canada, 2001). In Middlesex County, the area is smaller, at 40 hectares (98.9 acres) (Census Canada 2006) due to the types of farming done. This relationship has been defined by hands, horses, motors, and tractors over two centuries. The number of tractors in Canada has increased from 1.2 per farm in 1921 to 3.2 per farm in 2001, allowing farmers to work more land (census Canada, 1921, 2001). In the 1800’s, the horse and plow worked the fields, and the term horsepower was coined as a measure of the rate of work. We still use this system of measuring the power of the tractor, and some of the current tractors can reach 530 horsepower (John Deere model 9630T). Both these technologies define the relationship between the farmer and their land. The chemical fertilizers and tractors increase farmland production, but not necessarily profit.

Chemical fertilizers and tractors have had the largest effect on land stewardship and energy. A tractor allows more land to be cultivated by one farmer and fertilizers increase yield; however, both these tools use more energy. Energy usage in agriculture is spread in the following way: 31% manufacturing inorganic fertilizers and 19% in field machinery operation (Pfeiffer 2006, 8). Chemical input allows one acre to produce 240% (for corn) more yield per acre than in 1937 (Oelhaf 1978, 4).

It seems that as farmers become distracted with increasing production, they forget to consider the consequences of their actions. Wendell Berry, an ecological writer and sustainable farmer, states that a farm can be too large. Large farms are more prone to the displacement of man to land relationships (Berry 1981, 121). As the farmer steps into the closed cab of his air-conditioned tractor, they can lose touch with the soil of the field. It becomes too easy to forget about what the soil feels, looks, and smells like. New technologies, such as GPS micro-farming, further distance the farmer from knowing and caring about the land. The technology and the process of cultivation have taken precedence over looking after the land.

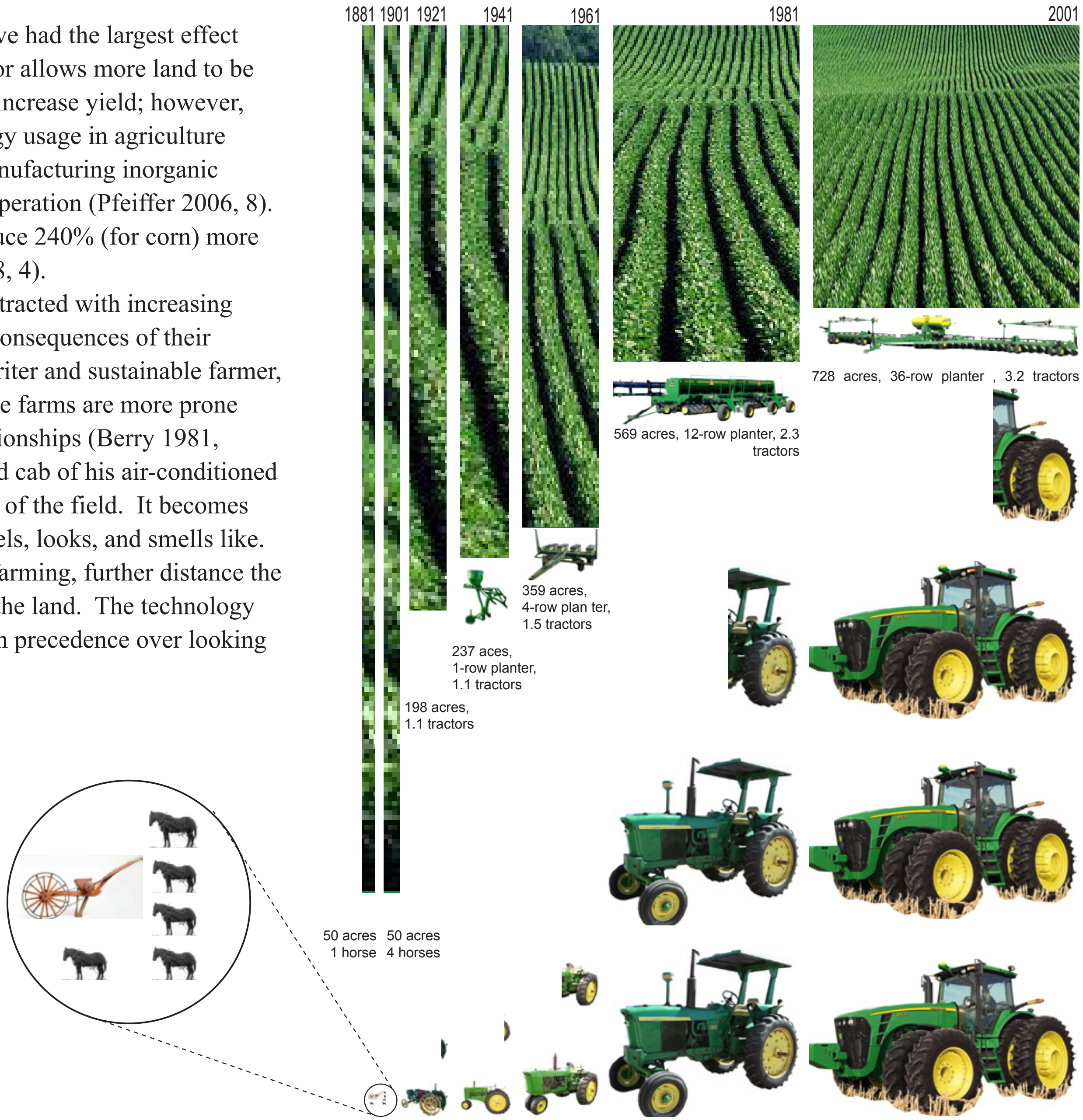


Fig3.11; The farmer works the land with his tractor or horse and this machine defines his relationship with the land.

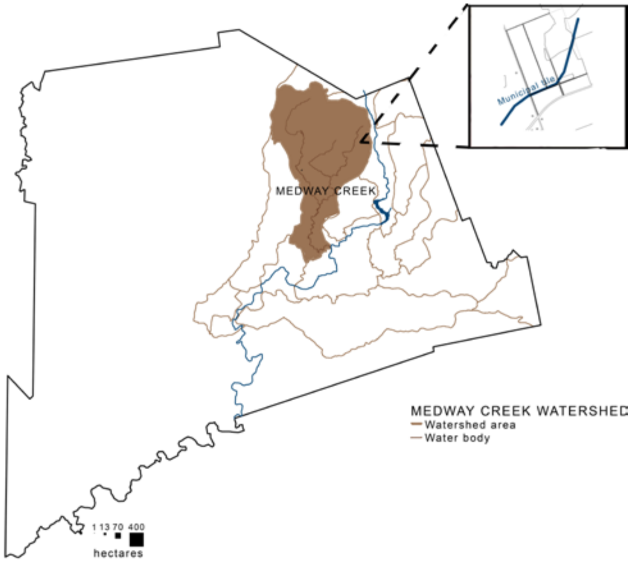
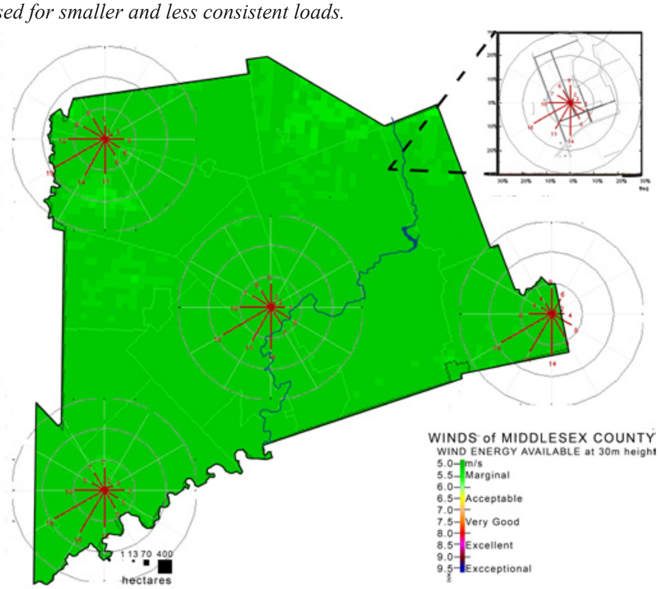


Fig3.12; The majority of Middlesex County drains into the Thames River. The chosen site is influenced by the Medway Creek.

Fig3.13; The potential wind energy in Middlesex County is marginal. However, it can be harnessed for smaller and less consistent loads.



ECOLOGY AND ENVIRONMENT

Ecology and environment are related to land, in that care must be taken to maintain it. The environment and ecology of a certain location both have a great effect on how agriculture operates in that area. Ecosystems influence the way in which a farmer manages their crops and livestock. Ecosystems are closed energy loops and maintain balance within the environment. Mimicking natural ecosystems is becoming a method of farm operation that creates quality products and maintains the environment.

With the growing scale of farming, it is easier for farmers to operate specialized farms, and many farmers now only have one or two types of crops (livestock or plants). In the past, many farmers grew some of everything to provide food for the family and for sale. The more recent trend of monoculture farms has caused environmental problems. Single species crops affect nutrient balances: for example, a monoculture of corn requires more nitrogen than the soil can provide. The lack of biodiversity within monoculture fields has major negative impacts on the other species in the area, both animal and plant. The basic problem associated with a monoculture farm is that it is not a closed system (Pfeiffer 2006, 68). Nutrients are brought in by fertilizers, and nutrients are taken away from the land by removing produce and all green wastes. A large-scale monoculture dairy farm has no place available for the disposal of animal manure nutrients, and brings in large amounts of animal feed nutrients from the land somewhere else. In Middlesex County 1,255 farmers out of 2,525 farmers use manure on their farms. Two hundred and forty farmers sell their manure to others (Census Canada 2006). By closing this loop and creating a farm which operates like an ecosystem, we can re-establish the nutrient cycle and rehabilitate our resources (Pfeiffer 2006, 69). In order to do this, we must produce the feed on the same farm as the animals are raised on, and animal waste products should be used on the land belonging to the farm which they are fed on (Pfeiffer 2006, 70).

In order to close the loop, a farmer needs to understand what is part of the loop. He needs to understand the ecosystem he lives in. Most farmers instinctively know the basics, such as when there will be no more frost, when it is going to rain judging by the feeling that is in the air, or because the cows are coming home on their own. Awareness of these natural predictors can give a farmer distinct advantages.

There are two aspects of a farmer's ecosystem: abiotic and biotic conditions. Abiotic conditions are composed of air sheds, water sheds, geomorphology, soils, nutrients, and winds. Biotic conditions are made up of wildlife species and sometimes human-beings. Both these categories are influenced by farm culture and both of these in turn influence farm culture.

Abiotic conditions in Middlesex County are conducive to agriculture. In Middlesex County, the land is relatively flat for easy cropping. There are 3100 or more heat units available to the crops during the growing season, making it suitable for many types of crops such as corn, wheat, barley, alfalfa, vegetables, and soybeans. Heat units are the accumulation over the spring, summer and fall of the number of degrees gained each day; they affect the maturity of plants. Different plants require different amounts of heat to come to full maturity and bear fruit. Thus, certain varieties of plants do better in Middlesex County and must be chosen accordingly. The plant choices then affect the animal choices, as animals will need to feed off of those plants. The nutrients in the soil are also important to the growth of the plants and animals chosen. Nitrogen, phosphorus, and potassium are the most common nutrients assessed and added to soils by farmers. In a natural ecosystem, nutrients are given and taken from the soil by the plants. In a monitored ecosystem like a farm, these nutrients often need to be added to depleted soil. Nitrogen is a nutrient which is manufactured from fossil fuels and is excessively applied on many farms in favour of assisting nature in restoring nutrients with manure and crop rotations.

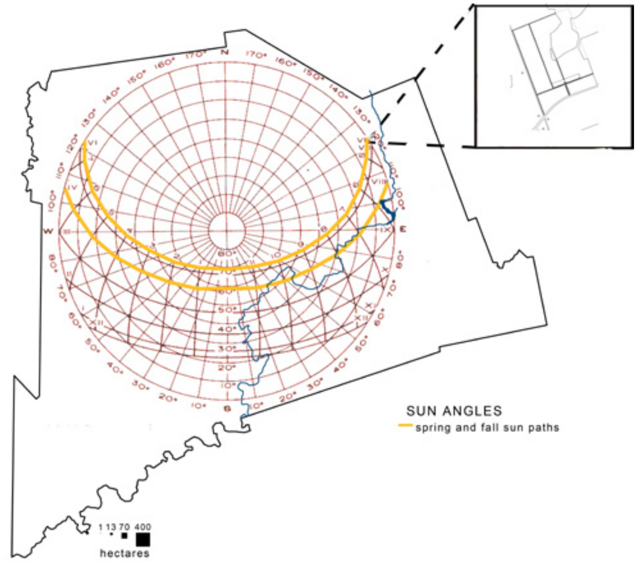


Fig3.14; The sun has a major influence on the site. A farmer can take advantage of heat gain potential and shading.

Fig3.15; Generally, the soil in Middlesex County is a loam soil, good for crops.

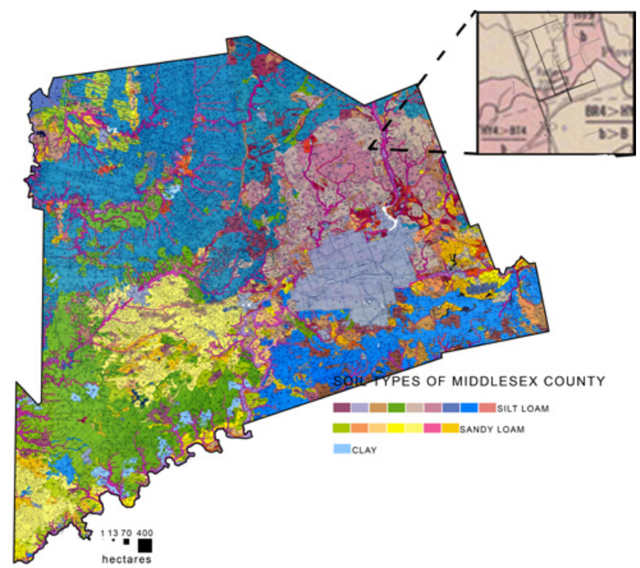
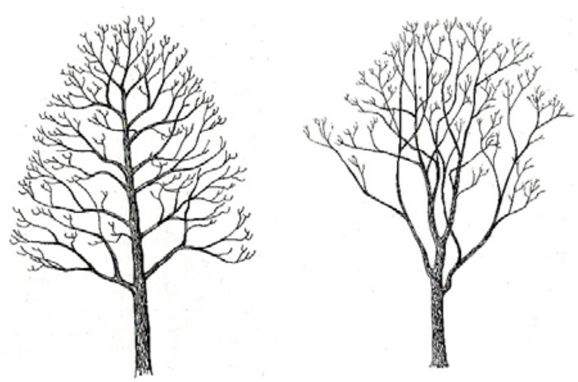


Fig3.16; Native trees of Middlesex County; black walnut, dogwood, sassafras, nothern hackberry



Analysis of the site conditions is important to designing a farm. The Thames River flows through Middlesex County. Although the site is closer to the Thames River, the site drains in the opposite direction, towards the Medway Creek, which meets the Thames River 10 kilometres south of the site. The prevailing wind in the county is from the southwest and the cold winter winds are from the north, telling the farmers which edges of their field they should plant wind breaks, and collect wind for ventilation. Six out of seven townships have not oriented the concession roads in a directly north-south or east-west orientation for solar gain possibilities.

Southwestern Ontario contains class one soils, which are highly productive for agriculture. Class one soils have defined where agriculture occurs in Canada (refer to appendix 1). The definition only accounts for types of soils and ignores cultural factors surrounding these areas. Often class one soils are being threatened by urban growth (Walton 2003, 14). Different soils again affect the type of plants growing in the area. Across Middlesex County, there is a variation of soil. The site chosen for this thesis is a loam soil and is good soil for growing crops as it is an ideal balance of clay, sand, and silt. In the eastern side of the county, a lot of clay soils are found. The farmers in the eastern part always plant later in the spring and often suffer rain damage because the soil does not dry out very quickly. Loam soil allows good drainage and retention of water, and ideal growing conditions for certain crops. These abiotic factors affect how a farmer must operate in a particular place and affects the design of this thesis.

There are also many biotic conditions unique to Middlesex County. The abiotic factors above affect what type of crop can be grown in the area. Appropriate species of these crops do better in the climates they are designed for. The biotic factors include plants, fungi as well as occasionally people and animals.

The county is on the edge of the Carolinian forest as well as the mixed wood plains ecozone. The Carolinian forest is mostly a deciduous forest composed of black walnut, red ash, and sassafras species. Farmers have been encouraged by governing bodies to plant coniferous trees that are not native to Middlesex County as fencerows. The non-native trees threaten the natural balances of particular ecosystems.

There are essential environmental benefits for having a polycultural ecosystem farm. It encourages a balanced system where diseases, pests, and nutrients remain in control naturally. When perennial native species are used, they can reduce the maintenance required by the farmer because they are designed to grow in the particular conditions of the site. Bio-pesticides are examples of using the natural tendencies of native predators to eliminate serious pest damage in crops. For example, using a fence row of diverse native plants can encourage deer to eat there rather than destroy crops, or encourage predators of common field pests like birds to eat aphids. Having a diverse farm with plants and animals is even better for the health of the farm. It not only allows the nutrient cycle to be balanced, but it can also benefit the economic health of the farm by increased yields, healthier plants, and intense use of land. Understanding the native animals and vegetation can help a farmer operate a component of a complex ecosystem that is larger than his farm.

Fig3.17; Native herbs chosen for the pastures; aster, tick trefoil, switch grass, big bluestem, Canadian rye, indian grass, bush clover

Fig3.18; Native trees chosen for the pastures; butternut, white oak, shagbark hickory, hop hornbeam


1861


1881


1921


1961


1981


2001

Fig3.19; The agricultural architecture has evolved from simple solutions to complex technological solutions. Some contemporary barns are beginning to use passive building systems.

ARCHITECTURE, TECHNOLOGY AND SOCIETY

The barns of contemporary agriculture have become machines for producing food. "Agriculture has been changing dramatically as farms become larger and livestock producers take advantage of new technologies and new systems for receiving and handling animals" (Kallen 2006, 41). Contemporary farm architecture is responding to technology rather than site or landscape. With the industrialization and growth of farming, larger animal facilities were needed just as larger areas of land were needed for crops. This has brought a new set of problems, which have been dealt with using technology rather than architecture. Many barn environments are mechanically controlled to produce maximum food outputs. In 1974, a mechanically controlled poultry barn in the Northern States used 3829 kilowatt hours for 100 birds. For a semi and environmentally (outside conditions) controlled barn in the Northern United States, 226 kilowatt hours were used for 100 birds (Pimentel 1980, 385). These methods bring large amounts of energy from elsewhere into the farm ecosystem in order to maximize production. Again, this change brought farm architecture from a solar powered building to a fossil fuel powered building.

Architects are being taught good building practices in order to reduce energy usage; these include south orientation, good insulation, thermal heat sinks, natural ventilation, moisture protection, green roofs, water harvesting, shading devices, and quality windows. These practices can be applied to farm architecture as well. Eric Arthur writes about contemporary barn architecture with qualities that are desirable.

> We accept these new farm buildings as we must accept the inevitable, but we look forward to their evolution in matters of design and material to the point where a comparison may be made with the barns of an earlier era in which beauty and surprising degree of efficiency emerged as a solution to the basic problem of feeding, storage, and shelter (Arthur 1972, 21).

The contemporary vernacular cannot be ignored, as many benefits have come from their design, but there are also benefits from traditional methods, and contemporary green methods.

Farming has an important symbolic meaning. The architecture of the countryside “conjures a nostalgic rather than real interpretation” (Schauman 1986, 105). The image of the countryside continues to be a small farm with few animals. These notions are embedded within our culture and are even illustrated in the basic drawings of children. The cultural notion of a farm has nothing to do with farming itself, but with the desire for a connection to nature. Its meaning is more important than actual form.

Society continues to dislike the industrial farm architecture that has taken over the countryside. This phenomenon has labeled farms such as these “factory farms,” carrying a connotation of inhuman farming practices and destruction of the family farm. Society continues to reject the current farming practices even though farming cannot operate in the same way that historical farms suggest it should. “Ontario’s 19th century vernacular is beyond recovery, however much it is craved. Awareness cannot be un-invented in an informed, interactive society” (Troughton 1993, 20). The farm must change as technology changes, but if the relationship to nature can be conveyed in the modern architecture of farms, it may be possible to relate the image of farming held by society to the actual practice of farming.

The vernacular architecture of Middlesex County is the wood bank barn and the contemporary vernacular is the colored corrugated steel barns. The houses are made of yellow brick throughout most of documented history, with a brief period of prosperity where the houses were then bricked using red clay.

Fig3.20; “..landscape as sanctified because farming is a noble endeavor basic to all economic pursuits - perhaps even to democracy.” There is a placelessness of modern farm technology. “Do the structures of modern farm technology evoke similar pleasant reactions?” - Sally Schauman

Fig3.21; “...the countryside conjures nostalgic rather than real interpretations.” “Perhaps more than any other landscape, the tended fields of the countryside symbolize our most revered meld of man, nature, and time.” - Sally Schauman

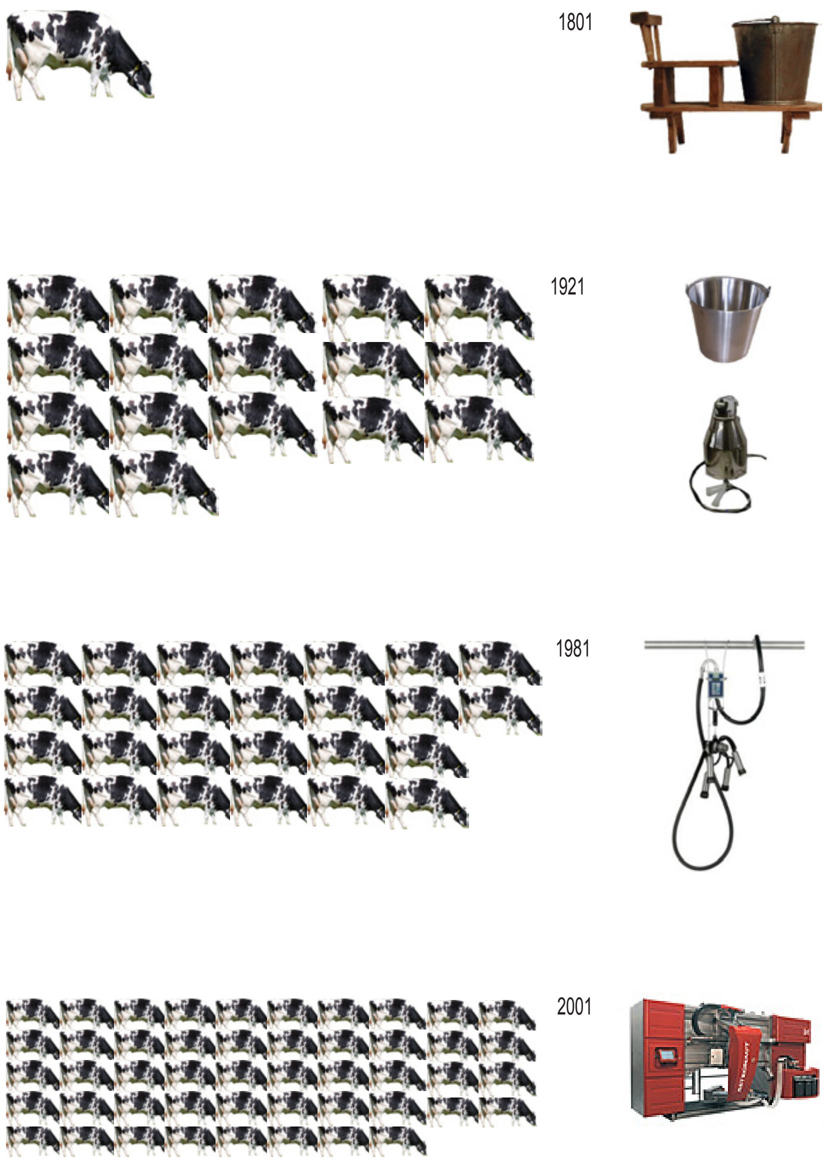


Fig3.22; Mechanization can make farming easier and be bennificial to skilled farmers.

MECHANIZATION

As the scale of farming grows, and herd sizes grow, more and more technology is developed to increase the amount of work one farmer can do on one farm. The mechanization of farming has been a process of slow improvements of technology. Up until 1830, the main tools for farmers were buckets, axes, spades, and hoes. In 1830, cast iron plows were used instead of heavy and cumbersome wooden tools. 1840 brought lighter and more efficient harrows and other implements. The steam tractor and threshing machine came in the late 19th century. Between 1930 and 1940, rubber tires were put on machines, allowing ease of pulling. Farmers began pulling implements by tractors and individual power units were placed on machines such as combines, lettuce and vegetable pickers, and fruit pruning machines. In recent history, milking machines have been automated to finish milking and are attached to cooling systems to avoid human handling and human error (Dasgupta 1988). Robotic milking machines are the newest form of machinery used for dairy herds; they can run for days without human intervention. In this way, new tools are replacing old ones, and many of the newest tools operate without the need for a human. These are only some of many machines implemented to increase efficiency and production on farms.

These are only some of many machines implemented to increase efficiency and production on farms. The workload on the farmer is reduced and more time for leisure becomes available. Feeding cows would take 2 hours to mix and feed by hand, but with automated feeding systems, it takes a few hours a week to mix and adjust the machines. Machinery and equipment account for 6% of the total energy used per cow and replacement (Pimentel 1980, 373). Farmers are not going to give up these tools and their time to reduce the energy they use in production. They need tools that are sustainable and that take into account the farmer's needs as well as the environment.

Mechanization has devised some very clever and useful tools for farmers. However, "even such a tool can cause bad results if its use is not directed by a benign and healthy social purpose" (Berry, 1981, 108). There are two opposing cases Berry sets out in the book, 'The Gift of Good Land.' One case considers a careless farmer who is only concerned with the machine. The second case depicts a farmer who is careful, knowing, loving, and produces high workmanship because he considers where and how the machine is used. The machine alone cannot produce quality food, it must be operated by a good farmer.

The previous issues are key issues that can be dealt within architecture and thus provide the context of this thesis. There are several issues which are not directly dealt with in the extent of this study, however, they are common issues found in rural communities. They include economics, urban sprawl, an aging farm population, and consumerism.

ECONOMICS AND AGRIBUSINESS

The economics of farming has drastically changed over the past 100 years. Production and marketing are two major players in the agriculture sector which have taken a share of the limited income in the market slowly over the past 50 years, reducing the farmer's share to less than 20%.

An agribusiness mentality has turned the farmer into a consumer of technologies with a need to be the most up-to-date and competitive in the marketplace. As farmers try to keep up with the economy, they invest in more land, machines, and technology, which increases production costs. Economies of scale play a major role in determining how farmers need to operate. Farmers feel that they must grow bigger or get out of farming.

Marketing boards like the Dairy Farmers of Ontario (DFO) use a quota system to control supply and demand in the market. Farmers purchase quota from the DFO, receive membership and in return and benefit from a more consistent price for milk. The marketing boards also get to regulate many aspects of farm operations. For example, the DFO requires that all milk to be sold to the pool and not a drop can be sold privately. Farmers are reacting by establishing co-operatives like Gay-Lea, and having stocks in the farm to allow many owners to take raw milk from the farm, as in the recently shut down Mike Schmidt farm.

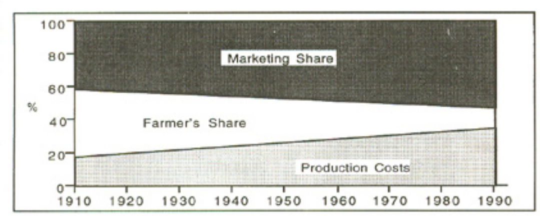


Fig3.23; The farmer's share of the percentage of the consumer food dollar

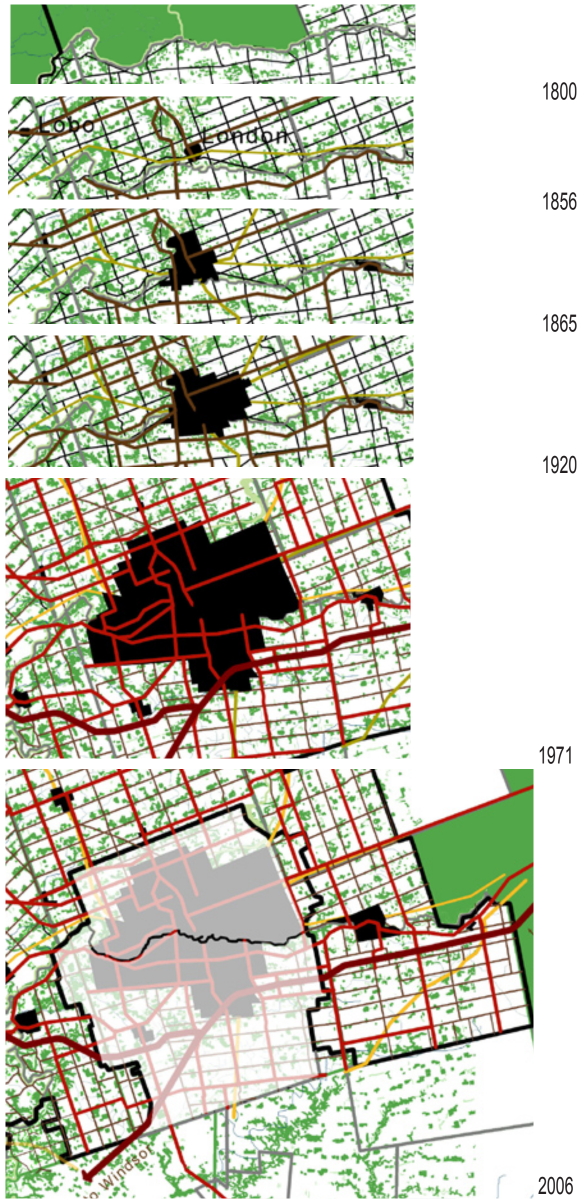


Fig3.24; The expansion of London into Middlesex County's farmland has been quick and continues to expand.

URBAN SPRAWL

Urban centers affect agricultural land, culture, community, and land usage. London, Ontario is slowly dominating Middlesex County. London has grown very quickly and is taking over valuable agricultural land. As the city expands into the country, many cultural conflicts occur. City dwellers often express distaste for the smell and noise as well as impatience with slow-downs on the road and general un-appeal of a rural area, deeming it "ugly." These issues must be dealt with through public relations and sharing of information. Farmers are also impatient with the culture of their city counterparts. The cities are drawing wealth of talent and money out of the rural and small towns and into the city centers. London has plans to continue to grow outwards; however, there are predecessors like Kitchener/Waterloo who have chosen not to destroy more agricultural lands and work within the city boundaries while having a growing population, thereby setting a precedent.

CONSUMERISM

Surprisingly, many farmers do not eat the food they produce on the farm. They choose to purchase their goods at the grocery store, thereby becoming a consumer. Berry argues that a farmer can save about $5000 each year by having a woodlot for heating, a garden, a fruit orchard, a cow with one calf per year, and one pig (Berry 1981, 150). Eating one's own food yields not only economic value, but provides awareness of its quality; the farmers can thus appreciate the work they have put into their farm.

AGING FARM POPULATION

Aging rural population has been an issue for 50 years. The average age of Middlesex farmers is 52.8 (Census Canada 2006). How can we encourage young people to take over the farming operations? It is extremely expensive for young people to get into the business of farming. This is a serious problem for the agricultural community and it could mean the discontinuation of many small farm communities. Schools often encourage C or D students to take on trades or agriculture and send the A and B students to Universities (Salatin 2004, 2). With the amount of knowledge required to farm in the 21st century, Joel Salatin recognizes that the agricultural industry needs people who can think outside the box and think critically about all the aspects of farming. So how do we keep our children on the farm? Joel Salatin has a made a good start with his children. "So often we farmers sell ourselves short. We do not allow our children access, philosophically and emotionally, economically and aesthetically. We don't transfer this sacred baton to them so they get the big picture. If we devote ourselves to excellence, then that is a noble calling. We can devote ourselves to beauty as landscape architects, as nurturers of the creation that God has entrusted to us" (Salatin 2000, 5)

Agriculture is one of the most essential and basic industries. It feeds the world. Over the past 100 years, using oil as a cheap energy source, the industry has grown exponentially. It has grown to a scale and form which is not sustainable and not in keeping with the identity of farming culture. The scale of the system is extremely disproportional when compared to the agricultural community. The individual farm has also grown in size to a point where farmers can no longer be the good stewards of the land and animals that they have been for thousands of years. The farming lifestyle and values are being overrun by technology. Decisions are being made by machines, and the farm life and architecture are being designed around the machinery and equipment that operates the farm. These machines require farms to be large, efficient, and also use large amounts of energy. There continue to be issues surrounding energy, scale, and farm identity. With the amount of information and research available, energy use and sustainable farm practices will be at the forefront of technological research. This is the contemporary cultural and physical context of the agricultural sector. It is important that the thesis address scale and energy as overarching issues. It is also important to understand what the current culture of the agricultural sector is, so as to design optimally within this culture.

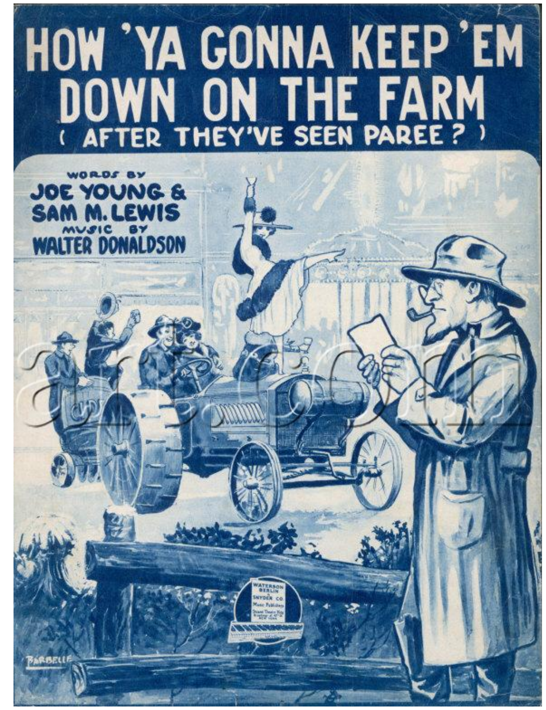


Fig3.25; A poster from 1918 that portrays the worry of farmers and the future of the family farmstead.

IV

THE

W O V E N L E A F A R M

A SUSTAINABLE FAMILY FARM

A garden, a landscape or even a whole farm, if it is to be successful by any standard, is essentially a creation and an expression of an individual. […] who share the same aims and traditions; for tradition has much to do with the beautiful garden, landscape or farm. There should be a rightness in relation to the landscape, to the climate, to the country, to the regional architecture, to the type of soils, even perhaps to the existence of the natural birds and wildlife. It should have a relation to the past region, to history itself" (Bromfield 1965, 76).

The barns and farmhouses of the past, present, and future are responsible for carrying the culture of agriculture through architecture. Woven Lea Farm attempts to carry meaning and place through its architecture.

Fig4.1; East-west section through the property of the Woven Lea Farm

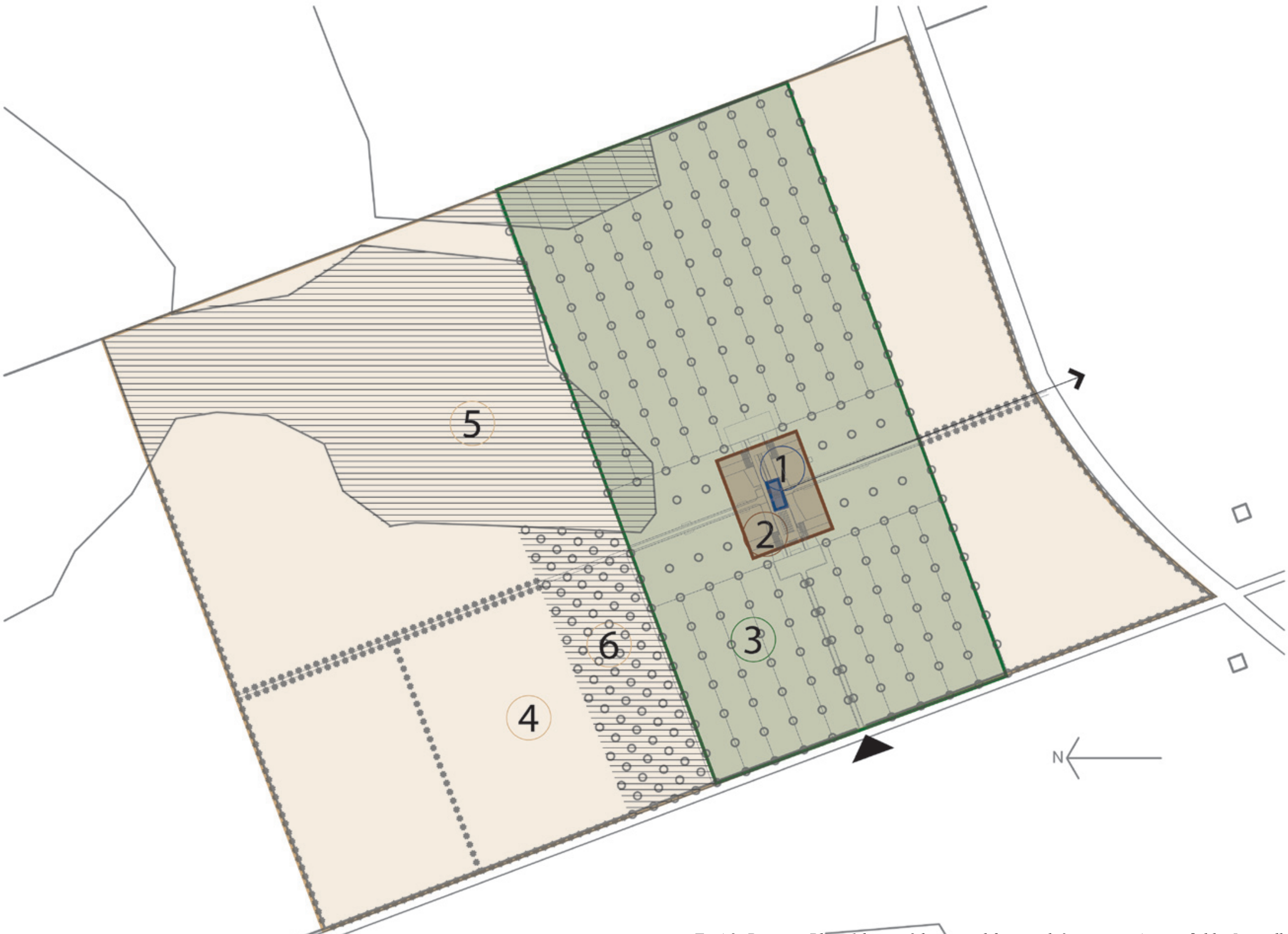


Fig4.2; Property Plan: 1 house, 2 barns and farmyard, 3 pastures, 4 grain fields, 5 woodlot, 6 orchard

The 60.7 hectares (150 acre) farm is a centrally designed plan, beginning with the land. Without the land, the farm is nothing. The site design begins with the land, as it is pushed and formed into a new landscape. The new landscape is two ramps, a large up-sloping ramp, and two small down-sloping ramps. This landscape provides the infrastructure for the rest of the farm. It contains program, supports the house, and defines circulation around the Farmstead. The house is in the centre of the property, the barns are the next larger layer, pastures are the next layer, and field crops are the final layer of the property. The four barns sit at the four corners of the ramp system connected to the up-slope for grain storage, the slope down for manure storage and grade level for animal, human, and tractor access. The house sits in the centre of the up-ramp and can overlook the whole property. Alongside the house is a silo form fulfilling many functions: vertical circulation, a water cistern and pumping system, and a wind turbine.

The farm design responds to site conditions. The main driveway is from the west off of the concession road as the neighboring farms also do. The main views of the property face towards the south with large windows. This also allows solar gain. The woodlot and planted orchard protect the north and east sides of the property from cold winds. The barns open up to allow the westerly winds to naturally ventilate.

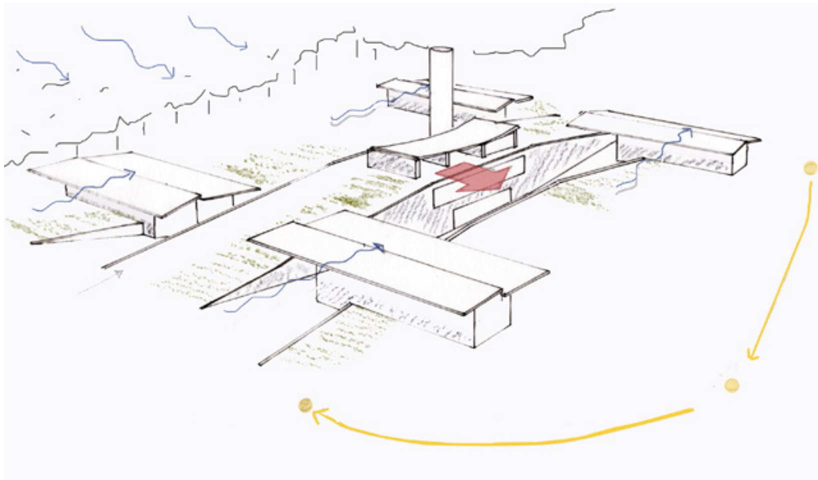


Fig4.3; The Woven Lea Farm responds to the site conditions. The woodlot and orchard protects the year from cold northerly winds, the barns are oriented to not have south heat gain and are ventilated with prevailing westerly winds, and the house is oriented with the long glazed wall facing south for solar heat gain.

The outer circle is the fields for grain crops. The average field size is 5.4 hectares (12.8 acres). These fields use a rotational planting system and are protected by dense windbreaks of native trees on the north, and shrubs on the south to maintain views. Hay, wheat, soybeans, corn, and sunflowers are grown on this farm. The tractors and other equipment used on the farm are stored in the centre of the property under the house of the +-0metre level. The fields are connected to the machine shed by lanes on the property and the grain bins are located on the +-0 metre level on the east side of the ramp. Grain is transferred into the bin from above using gravity, and taken out of the bin from below using gravity. From the main grain storage area, the grain is milled into animal feed, pressed for oil, or sold to a local feed mill. Hay and straw taken from the field are stored along the east and west bays of the barns for convenient use and wind protection. Hay for the dairy cows can be stored in plastic wrap for silage hay.





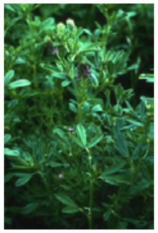


Fig4.4; Property Plan: 1-5 grain fields, 6 lanes, 7 grain storage. Crops which are planted are sunflower, corn, wheat, soybeans, alfalfa.

The four pastures which make up the next inside layer are each connected to a barn. Many native varieties of grasses and trees grow in the pastures for the animals to graze on. Each 5.25 hectare (13 acre) pasture is then divided into six parts: a common exercise yard and five paddocks. The paddocks are open for two days at a time for the animals to graze on before they are moved to the next pasture area. The rotational cycle takes 40 days.

Fig4.5: Property Plan: 1-4 pastures, 1a-e-2a-e-3a-e-4a-e paddock, 1z-2z-3z-4z exercise yard

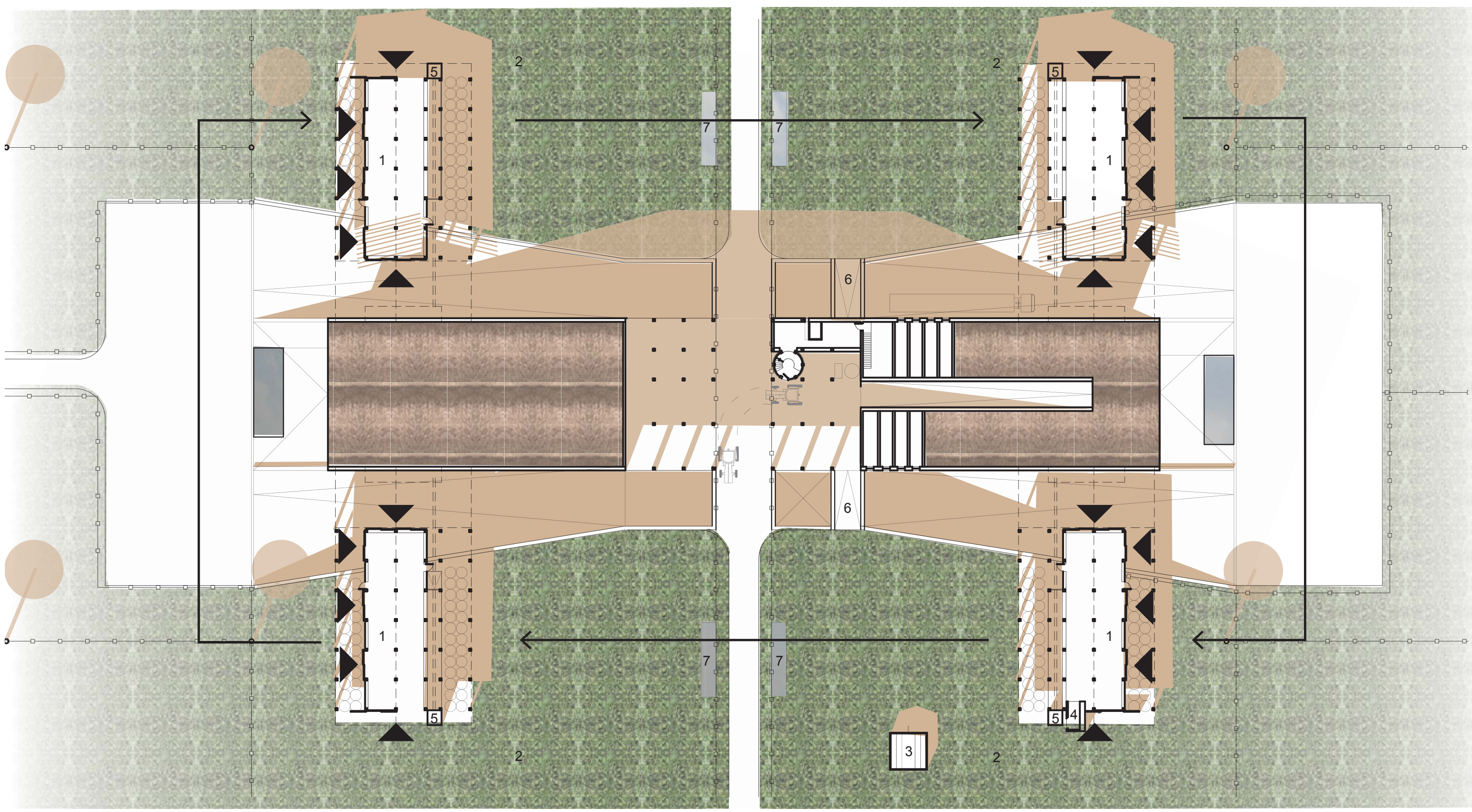


Fig4.6; Farmyard Plan: 1 barn, 2 pasture, 3 chicken coop trailer, 4 robotic milk machine trailer, 5 cistern, 6 methane digester, 7 water trough

Four barns house the 40 milking cows, 20 heifers and 20 veal cows, 15 sows, and 150 finishing pigs. Two moving trailers are used for the chicken coop and the robotic milker in the rotation cycle. The animals are bedded on a straw pack in these open barns, and they have constant access to the pastures. The barns are designed to be naturally ventilated and self-sufficient in terms of feeding and watering. Water is collected in the cistern and feeds the water bowls in the barn and the manger is filled with both hay and grain. Round hay bales are easily rolled out by hand, and the grain is distributed by an auger from the bin along the ramp. Windows on the east and west walls open for cross ventilation and a clearstorey expels hot air. The doors open on the north and south ends to clean the manure and straw pack out of the barn. The animals stay in a barn for 10 days at a time before rotating in the summer and for three months in the winter in order to encourage a diverse manure and compost pack which will be spread on the fields or digested in the methane digester on the -5 metre level.

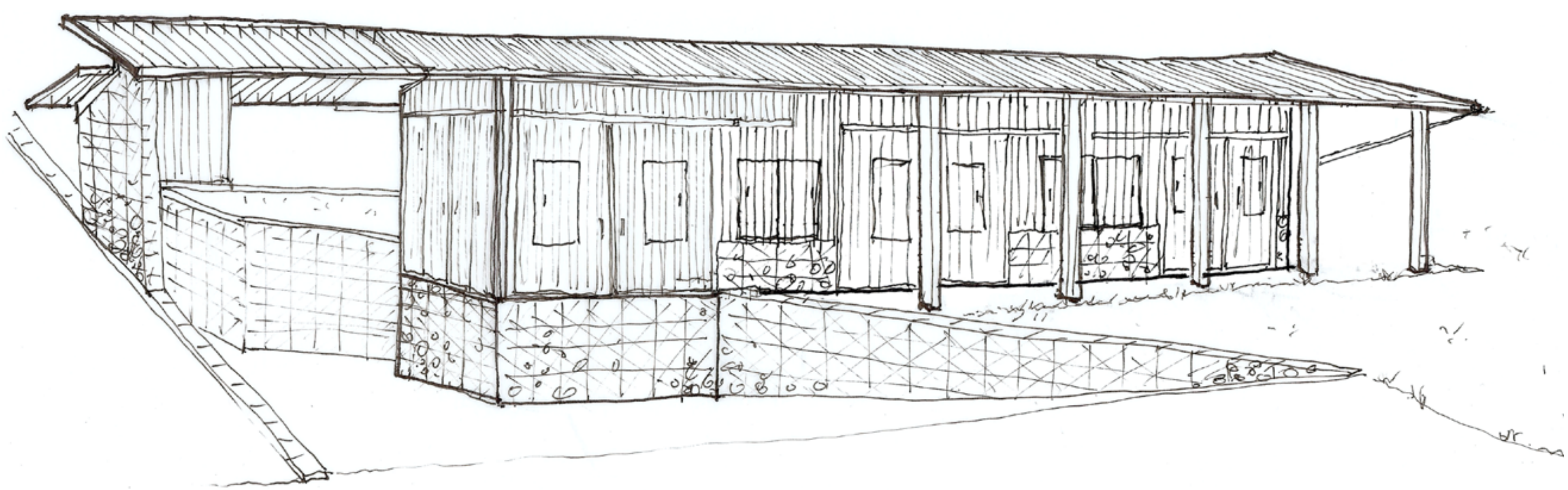


Fig4.7; One of four livestock barns on the Woven Lea Farm

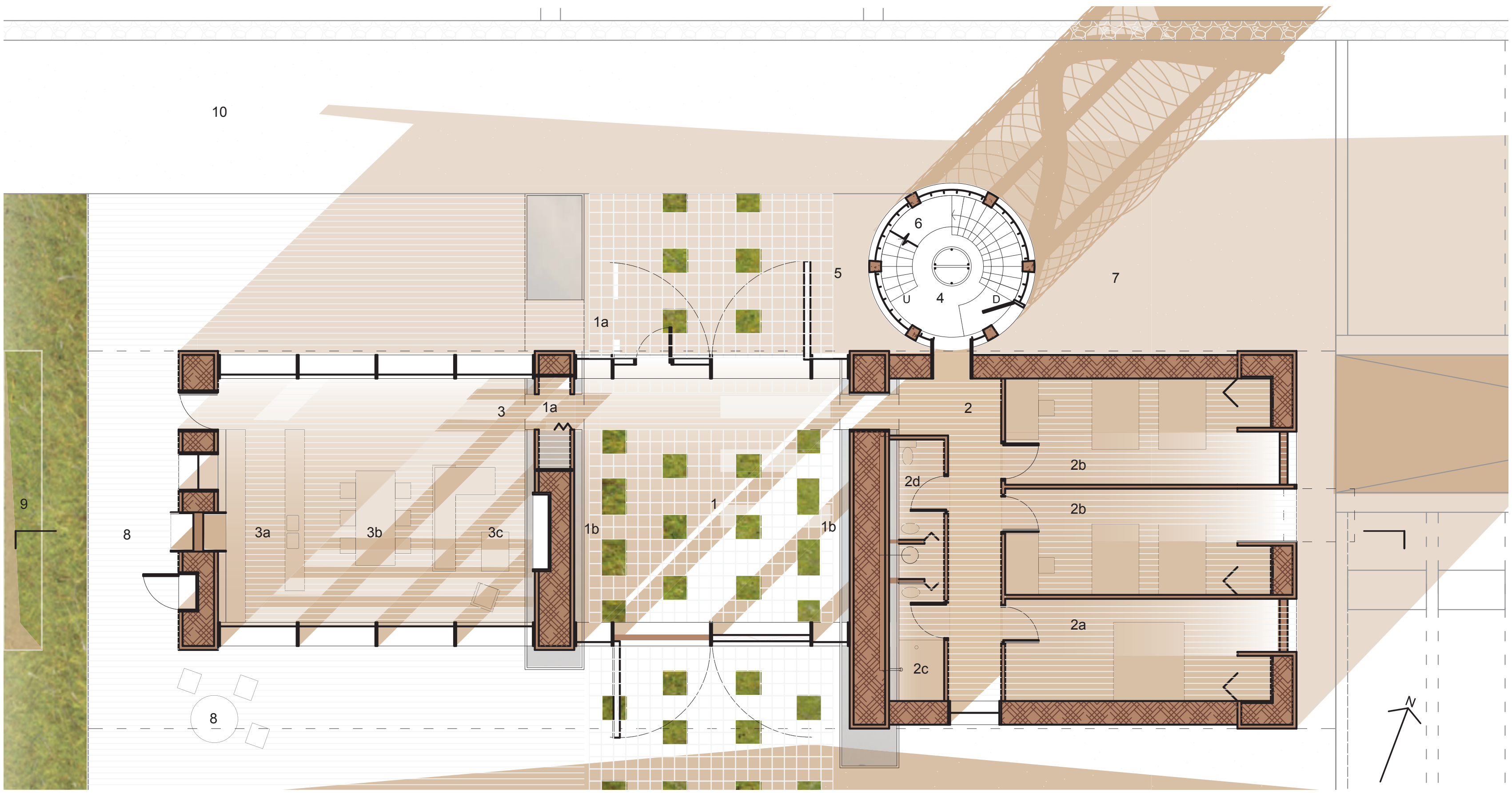


Fig4.8; Ground Floor House Plan: 1 central porch, 1a main entrance door, 1b water pool, 2 private area, 2a master bedroom, 2b children's bedrooms, 2c shower room, 2d toilet room, 3 public space, 3a kitchen, 3b dining room, 3c family room, 4 silo stairwell, 5 basement below with pantry, storage, and work washroom, 6 office above, 7 parking spot, 8 porch, 9 vegetable garden, 10 laneway

The farmhouse sits in the centre of the property on the highest level. Four major straw bale walls containing infrastructure organize the space of the house. The centre walls facilitate the collection, heating, and dispersal of water. The centre west wall also contains the entertainment unit for the family room. The easterly wall opens up to the bedrooms for fresh air and light from the morning sun. The westerly wall contains a fireplace for cooking inside or outside (in the summer), wood storage, and a garden shed.

The centre patio space divides the public part of the house from the private part of the house. This central patio is a space which can be open or closed. It is a protected porch, an entrance vestibule, and serves as winter garden and porch. Water which is collected from the roof is also stored here, with overflow being pumped to the cistern in the silo. This water is used for the showers, toilets, and kitchen. The skylights provide light for the garden. To the east of the central porch are the bedrooms and bathroom. The bedrooms receive the early morning light from the east. The kitchen, dining room, and family room are to the west of the central porch. This open space looks over the property to ensure things are running smoothly on the farm. The basement and work entrance on the lower level are connected by the silo. The pantry, work wash sink and storage are located here. On the +9 metre level is the office. The office is connected using a stair and a weighted grain elevator in the silo. This office is the managing centre of the farm and from this point, the entire Woven Lea Farm can be seen and monitored.

The materials to build the Woven Lea Farm come from the farmer's land. Straw, stones, wood, and earth combined with modern materials like corrugated steel, glulam beams, steel structure, and glass make up the construction of the farm. As the materials from the land are used, they are regrown through the processes of the farm.

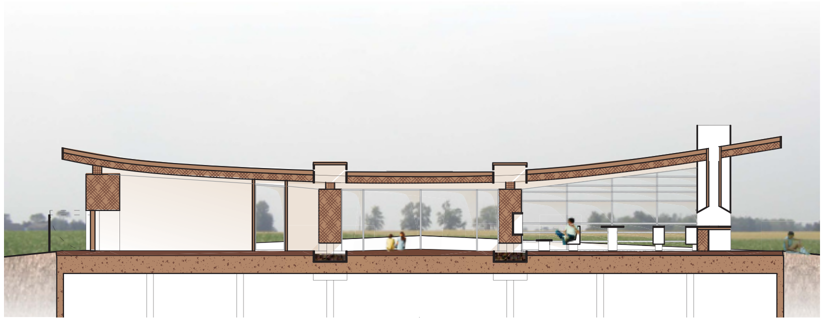
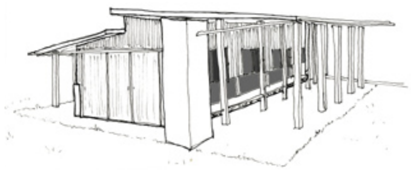


Fig4.9; Section of House

Fig4.10; The materials that compose the architecture come from the farmer's land. Straw, stone, wood, and earth. Other industrial materials are corrugated steel, concrete, brick, and glass.

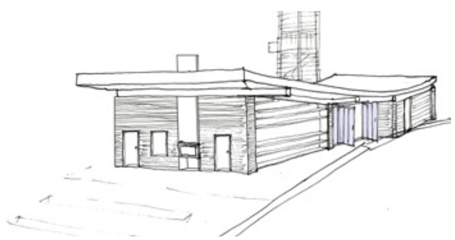
Fig4.11; Seasonal adaptations in the architecture.
Hay storage protects the barns from cold westerly winds.



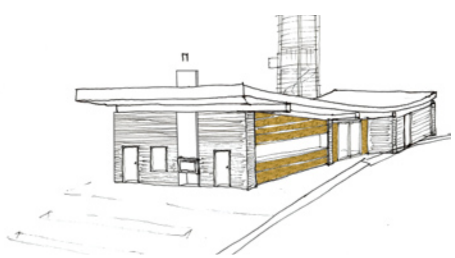
Barn Summer

Barn Winter

Straw bales can be inserted into the window frames of the house for extra insulation in the winter.



House Summer



House Winter

The seasons affect the operations of the farmer and they also affect the architecture. The house can be modified to accommodate the seasons. Straw insulation shelves are installed onto the house to reduce heat loss in the winter, and they provide shade in the summer.

In the summer, the farmer wants to be outside to enjoy the weather all the time; in the winter, he wants to be protected and cozy inside the house. The central porch can provide this place. The family can even feel as if they were outside in a warm rainfall. The central patio of the house opens to nature in the summer and closes to cold winter weather, so that living can take place outside. In the winter, this space is warmed by the southern sun and a winter garden can be grown. A fresh summer rain has a beautiful smell. As rain falls on the roof, it falls through the skylights into the pool inside the house, bringing the sound and smell of fresh rain into the house.

Fig4.12; View of public space of the Woven Lea Farmhouse

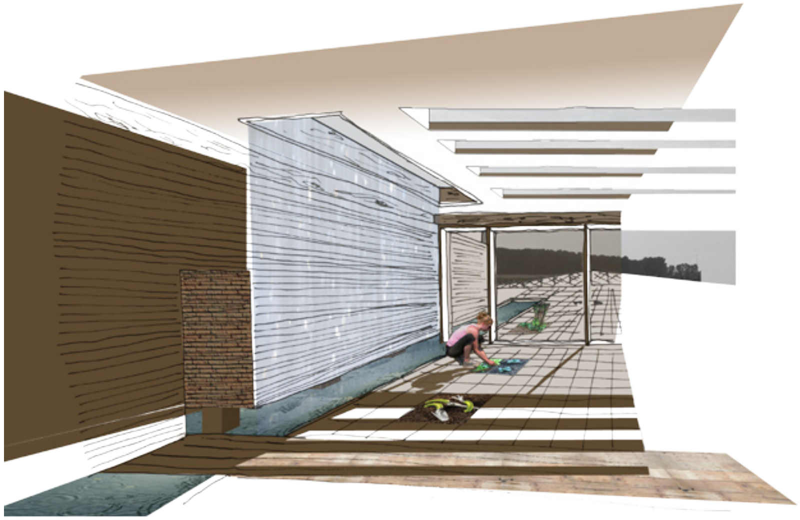
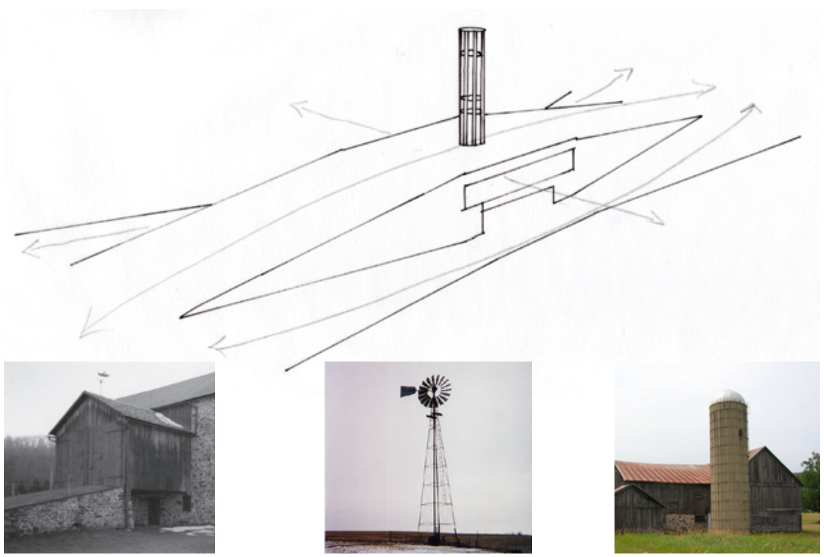


Fig4.13; The Woven Lea Farm interior water collection system. Beauty is made from the useful process of water collection. This feature could also be used as a rain gauge for the farmer.

Fig4.14; The ramp, windmill, and silo are reinterpreted for the Woven Lea Farm design.



The design thesis upholds Jefferson’s ideal about farming as a moral way of life, using some of Jefferson’s formal architectural language. The structure of the farm is reminiscent of Italian villas with a central space and wings coming out from it, and the symmetrical organization. The tree-lined approach conveys pride in the ownership of the farm. Also useful are Jefferson’s, best practice ideas. The design of the farm takes the best practices, or modifies good practices to make a better farm design. Many architectural strategies for sustainable and integrated design were looked at to design a complete farm which would arguably be better than that described by the ‘best’ practices. This strategy was also used for the farm operational design. Many common practices were evaluated and reconfigured to work better in the design of the Woven Lea Farm.

The functional elements which are required in the design of the Sustainable Family Farmhouse are some of the most beautiful elements of the design. The ramp system which defines the organization of the building design is a beautiful landscape feature, rising directly out of the ground. The water collection done within the central patio of the house is also beautiful and useful. When it rains outside, it also rains in the house, bringing the smell, dampness, and water into the living space. Downing contributed to the design with his theories about beauty stemming from usefulness. The design takes this idea further and makes the useful elements the beautiful elements as well. The usefulness of the design is also the organization of the design.

Farmers have designed many practical solutions to farming problems in their architecture. The design recognizes that there are inherent ideal qualities in many of the common farm structures. The design takes these forms and reinterprets them for this particular condition. The form and construction of the barn is not extremely different from past barns. It uses inexpensive materials for construction but is allows these materials to help the design. The corrugated steel and timber frame allows windows to be easily inserted for ventilation, and the unforgettable element of the eaves trough on a barn directs all the water to a cistern. The Woven Lea Farm also takes forms like the silo and the windmill, and redesigns them to suit this particular farm. The silo, which is normally is solid and contains silage for cattle, is reduced to the concrete columns and the steel rings. It acts as a vertical circulation for the four layers of the design. It also holds two essential sustainable strategies: the water cistern and the wind turbine. These forms evoke the memory of past farming and encourage new ideas and thoughts about agriculture architecture.

With the contemporary changes to a sustainable agriculture described in the pervious chapter, the farmhouse will undergo a new shift and the needs and values of the contemporary culture will be reflected in the architecture. This farmstead design reflects a future, sustainable farm appropriate to the information age. The complex ecosystem (elaborated on within the next chapter) that operates this farm requires close management. From the office space in the silo overlooking the entire operation, a farmer in the information age must learn to manage, evaluate, and balance the systems existing on the farm constantly.

Fig4.15; view towards the house and barns from the pasture

AGRICULTURE APPROACHES

AND THE WOVEN LEA FARM

Every farmer has an approach to how they should operate their farm and every farmer thinks their way is the best. This approach shapes the technologies they use, the organization, and the design of their farm. The accumulation of these approaches shapes our agricultural sector.

The research looks at artisanal, industrial, certified organic, and organic approaches to farming. These approaches are evaluated by their energy, environment, ease of use, culture, and economically viable applications to contemporary agriculture. The approaches are then adapted or reinvented for the design of the sustainable farm approach. The techniques described in this chapter are the many systems that are designed into the Woven Lea Farm.

There are four major approaches to farming: artisanal, industrial, certified organic, and organic. Artisanal farming is a simple way of life but usually only applied to small hobby farms. Industrial farming has evolved with the modernist cultural movement and organic farming is a reaction to the consequences of industrial farming. No one solution is perfect, but there are advantages to all. The agricultural sector is slowly moving to fit within the sustainable and information age; this movement can take advantage of all the knowledge produced by artisanal, industrial, and organic farming. The design addresses all types of farm approaches and designs a hybrid of all the ideas that have been generated. The combination is a complex ecosystem design.

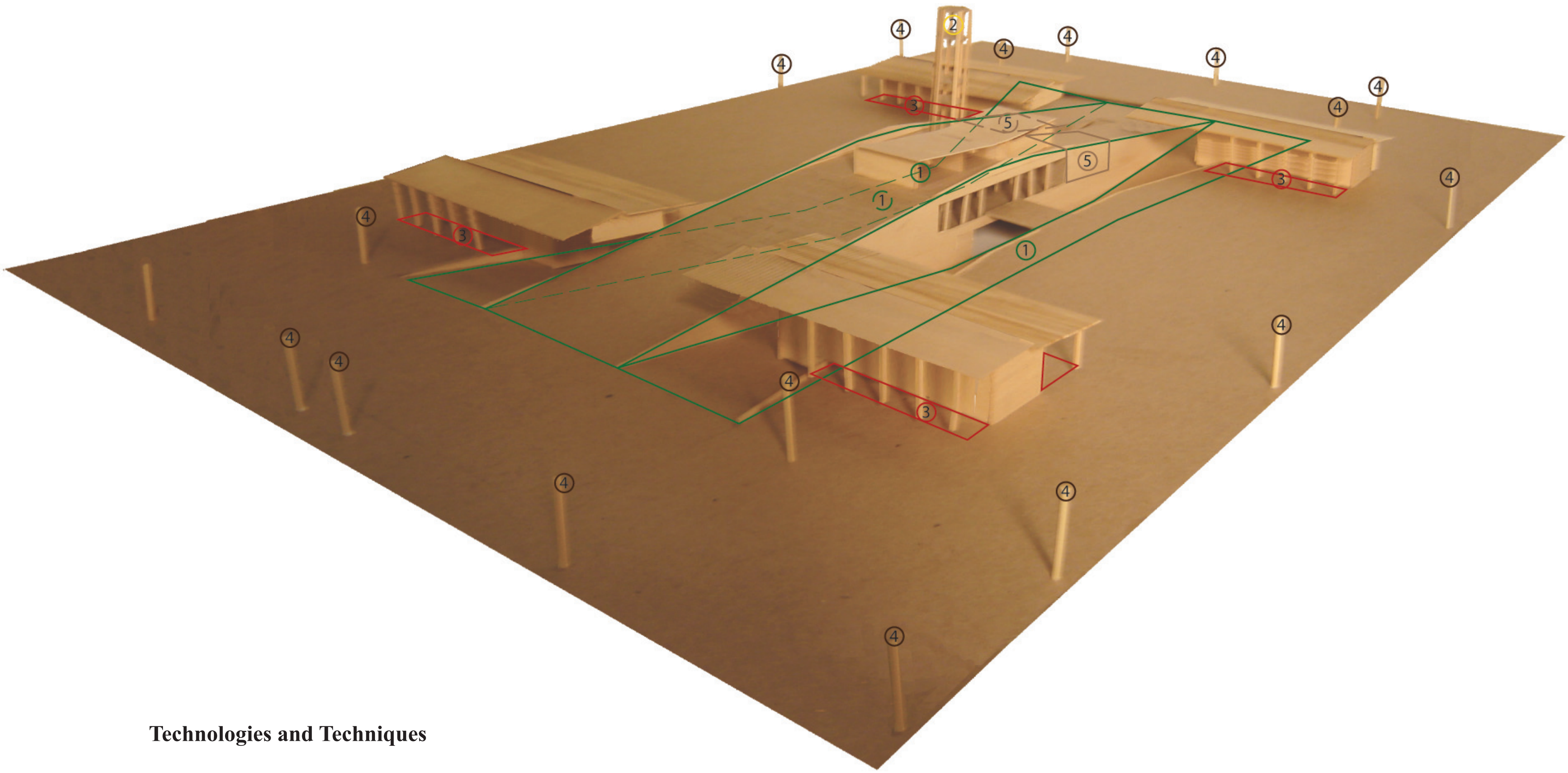
Fig5.1: Abandoned bank barn in Middlesex County. This is the versitile traditional barn type.

ARTISANAL FARMING

An artisan is "somebody who is skilled at a craft" (Encarta Dictionary, 2008). In this case, the craft is farming. Artisanal farming was a primary form of farming until the rise of industrialization in the early 20th century. Few contemporary farmers practice the traditional methods of farming outside of pioneer villages.

Traditional farms were "diverse enterprises" where the farmers produced and consumed their own crops and animals. They did not purchase what they could make on the farm. This included butter, cheese, clothes, jam, smoked meats, vegetable preserves, canned fruit, etc. In the book 'Traditional American Farming Techniques,' 24 pages are devoted to the practices of cooking and sewing. A cow was owned specifically to provide milk for the farm family. In short, a traditional farmer made use of all of their resources.

Artisanal farming is solar-powered farming. The sun's energy is harvested by the plants in the field and is then fed to the horses, oxen, and people who work the farm. Plants fed with solar energy are the most energy efficient machines; no human–built, fossil-fuelled machine can compare. For every kilocalorie input using artisanal farming methods, 128.2 kilocalories are yielded. When tractors are used, one kilocalorie outputs only 4 kilocalories (Pimentel 1980, 68,73). Although artisanal farming may be more energy efficient, no farmer is going to give up his 530 horsepower tractor for a team of horses. However, by operating the farm by hand, a farmer had an initiate a more intimate relationship with the land and animals. There is potential to reduce energy use in contemporary farming by using some of the techniques of traditional farming.



Technologies and Techniques

The following techniques are derived from two handbooks on traditional farming techniques. They provide valuable strategies for the design of the Woven Lea Farm with an economy of resources and energy.

Fig5.2; 1 ramp, 2 wind turbine, 3 hay storage, 4 shade trees, 5 hopper-bottom grain bins

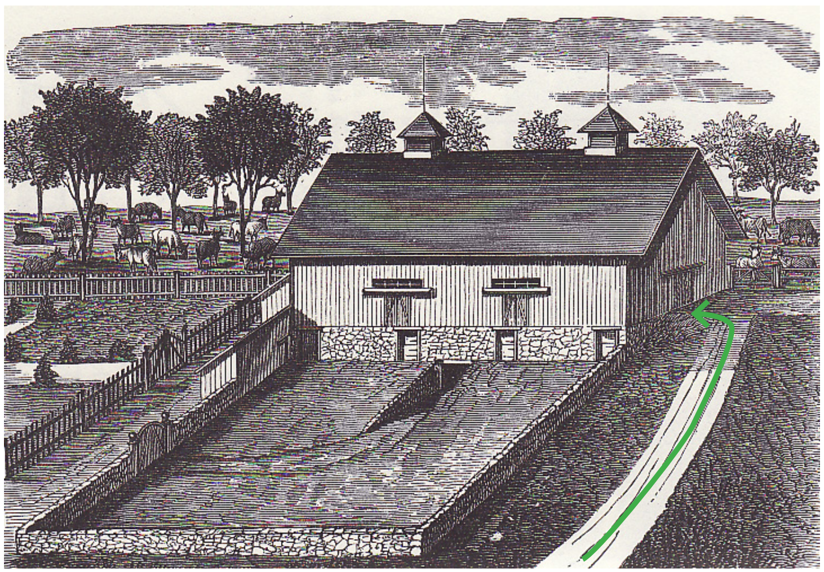


Fig5.3;

1 The Bank Barn

The bank barn is set into an existing or artificial hill to allow carts and horses to access multiples levels. A cart could drive up onto the second level and store grain and hay. This feed is then easily thrown down a chute to the level of the animals below. This strategy was also used for animals on the second floor. The manure would be thrown into a cart on the lower level and taken to the fields or storage.

The Woven Lea Farm uses this method as well to power grain moving by gravity and to allow the close proximity of the related program. Using this ramp system, all four barns are close to manure storage, the house, pastures, and tractor access. There are the many benefits to the ramps; tractor trailers can load animals and grain easily, manure is disposed out of the barns easily, manure is hidden from sight, and the house can view the entire property from its perch on the top of the ramp.

2 **The Windmill**

Traditional windmills are usually set near a barn. A windmill pumps water from the farm well to the water trough for the animals to drink from.

The windmill on the Woven Lea Farm is at a larger scale, but it does much the same task. It does not pump water directly, but it generates electricity to run the pump. The pump moves water collected from the roofs to the cistern in the silo and then gravity takes care of distributing it to the troughs in the pastures. The wind turbine also powers the grain press.

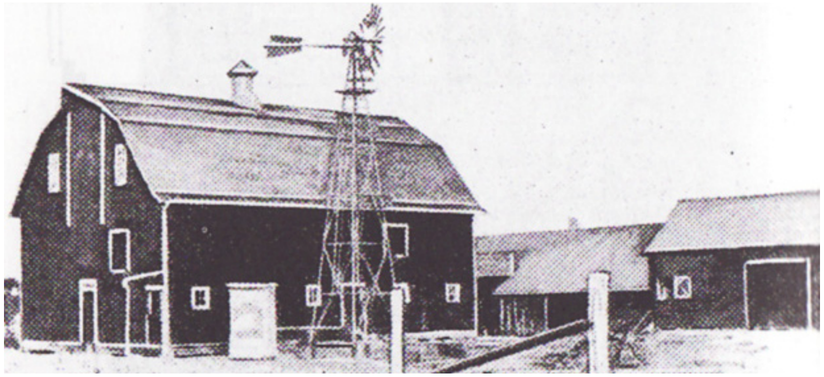


Fig5.4;

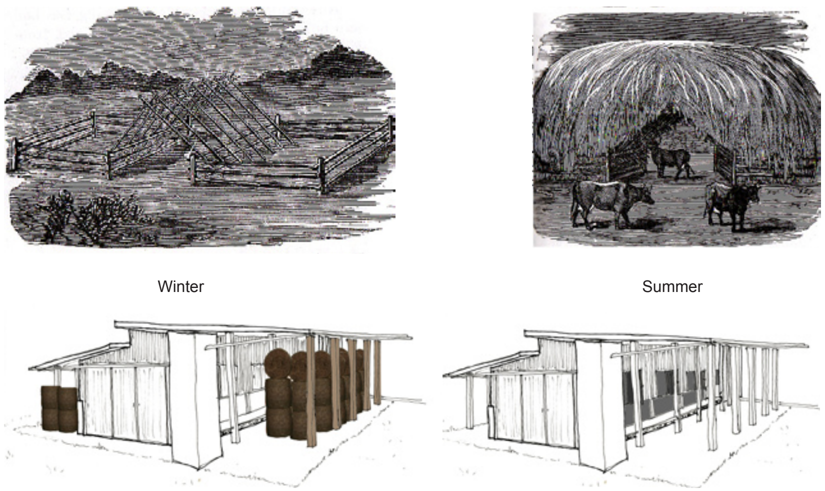


Fig5.5;

③ Hay Storage and Animal Shelter

In this technique, the hay becomes the insulation and the protection for the animals. The wood frame is constructed to hold loose hay. When the hay is stored, the animals have access to eat it and they get shelter from the sun, wind, and rain. This exact strategy is not suited for wet climates like Southwestern Ontario, as the hay will rot.

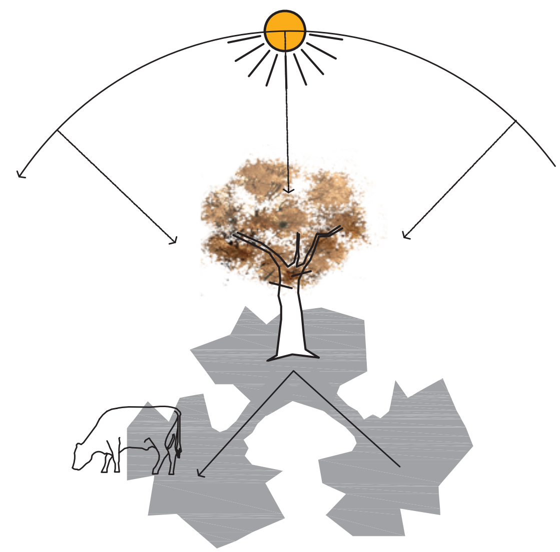
Each barn on the farm has a covered bay on the east and west side of the barn. For convenience, hay and straw are stored right beside the barn, where they are needed. This also provides a wind break and added insulation in the winter.

④ **Trees for Shade**

In the summer, animals look for shade. A tree which is planted in an optimal location on the field will be a form of manure spreader. As the shadow of the tree moves, the animals move with it, distributing the animal manure over a larger area of pasture.

The farm's pastures have trees planted out every 33 metres in the centre of the pasture. The species chosen are butternut, chestnut, white oak, shagbark hickory, and hop hornbeam because they are native to Middlesex County. These trees not only provide shade, but they produce nuts for the pigs to eat.

Fig5.6;



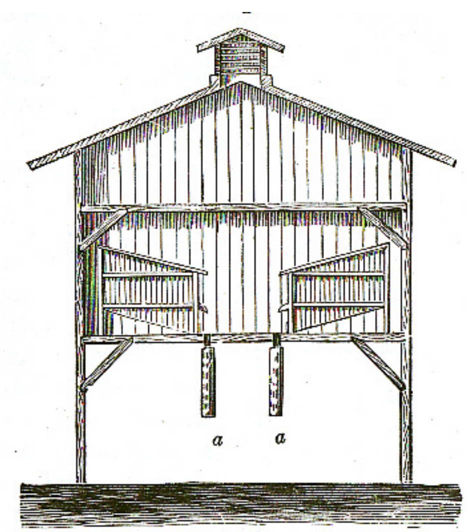


Fig5.7;

⑤ Grain Bins

Similar to the gravity-powered feeding system of the bank barn, with the proper slope on the bottom of the grain bin, this grain bin will empty itself without the help of man or electrical power. By moving the grain bin to a second level, a wagon, milling machine or truck can be filled without the use of an auger.

Two major ramps form the Woven Lea farmyard. They create the potential kinetic energy of gravity. The grain bins are located on the +-0 metre level on the east side of the house. Grain is dumped from a grain wagon into the bin from the +5 metre level on top of the ramp. Grain and milk is then collected by a truck for pick-up or the milling machine from the -5 metre level, using gravity to empty the bin. No augers are required until the milling machine deposits the grain at the individual barns.

Farmstead Efficiency Planning

An efficient farm should provide easy access to all areas of the farm. The house, manure storage, grain storage, and machine storage, should be centrally located among the barns, pastures, and crop lands. The farmstead should be neatly arranged for visual impact as well (Gardner 2001, 847).

The large ramp glides gently over the landscape and the down ramp creates a ha-ha condition, hiding the manure area. The house and many other functions are centrally located on the ramp for easy access to the farm. The dense program in the centre of the ramp allows efficient movement of energy, heat, cooling, air, and manure.

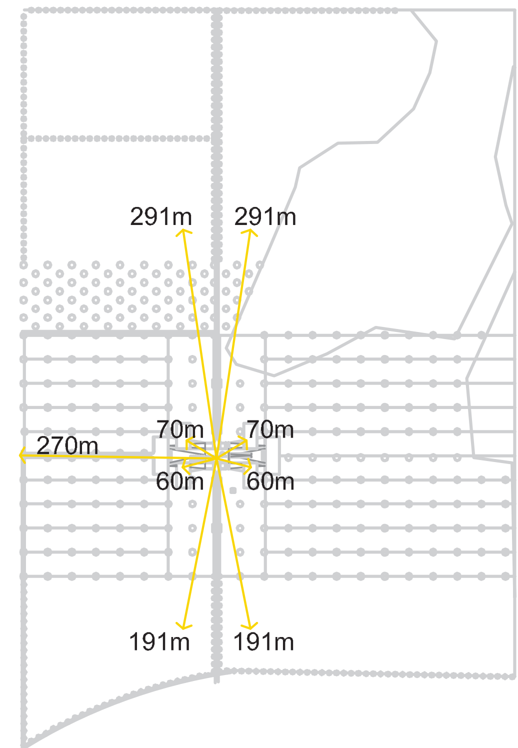


Fig5.8;

Fig5.9: The contemporary industrial barns have a unique quality at night and during the day. The curtain wall frames the horizon line. At night the barn is a bar of light on the horizon.

INDUSTRIAL FARMING

Industrial farming is governed by factory logic rather than an artisanal logic and stems from science and technology. Factory logic is the breakdown of a task into smaller steps which are repetitive and can be performed by a machine. Industrial farming began with the tractor in 1920 and was followed by more machinery designed for every type of field work. In Fitzgerald's opinion, "nearly every industrializing process happened because someone thought outside the artisanal logic and broke down complicated processes into multiple discrete, isolated actions" (Fitzgerald 2003, 24). The process of growing grain was broken up into planting, weeding, watering, fertilizing, and harvesting, and a piece of machinery was made for each task, all pulled by the tractor. Thomas D. Cambell, who owned one of the first successful large industrial farms, said "modern farming is 90 percent engineering and 10 percent agriculture" (Fitzgerald 2003, 175). To most farmers, industrial farming has become a way of life. In order for it to be a success within the industry, an industrialized farm requires large-scale production, specialization of machines and crops, standardization of processes and products, as well as reliance on managerial expertise and efficiency.

In 1920, industrial farming promised many things, and on the whole, people felt very positive: it was a new way of life for farming, the agricultural science and agricultural organizations were a unifying system for many different practices and problems in farming, and it was a road into the future of farming (Fitzgerald 2003, 12). Industrial farming has obviously been adopted by almost every farmer who remains in business. Like modernism in architecture and culture, farming also painted a grand and optimistic picture of the future:

> 'Imagine, if you can, a 350-acre farm fairly painted white with S.C. White Leghorns [breed of chicken]; also a roadway a mile long leading all the way between poultry houses adjoining this roadway on either side, then consider just what it meant

> last spring to put out on the ground of the home plant more than 75,000 baby chicks, then you will have a pretty fair idea of the extent of the M. Johnson Poultry Ranch' (Fitzgerald 2003, 106).

This is a beautiful picture of what industrial farming looks like; the fields and barns full of tiny yellow fluff balls. The long contemporary industrial barns glide cleanly along the horizon. The open side barns perfectly frame the horizon within the timber frames, and are long bars of glowing light at night. In many ways, factory farms still convey a sense of grandeur and command of the landscapes they occupy.

Contemporary farming has come a long way technologically. When machines were first built, they were meant to replace skill rather than enhance skill. They are labor-saving devices. A bad farmer could have a tractor and planter and still not get a good crop if he does not know how to plant and care for his plants. Those who replaced good, well-paid farm workers for tractors and cheap, unskilled tractor drivers learned their lesson the hard way after machines broke down or yields were lost. A farmer who operates a tractor still needs to understand how plants grow and how to look after them. Contemporary farming has forgotten the important lesson that machines alone cannot, by nature, produce better food: a good farmer who employs good practices is needed to accomplish this.

Another problem coming out of industrialization is the need to compromise good or traditional practices in order to accommodate industrial processes. Technology does not solve problems; rather, it brings on a different problem set with it. For example, the invention of the cotton picking machine required a redesign of the cotton producing system. New breeds of cotton were needed that carried the bolts higher on the plant so that the machine could pick them; gins were redesigned for the new breeds of cotton; herbicides were needed to save the harvesters from contaminating the picked crop. In Fitzgerald's opinion, "clearly when cotton picking was mechanized, it was industrialized as well" (Fitzgerald 2004, 14). Three concessions needed to be made for one machine invention. Reinvention continues to occur in contemporary agriculture. Energy-efficient and energy-producing devices are being designed to produce the excessive amounts of energy required to operate the modern farm, where energy usage and waste could simply be reduced. Industrial farming is developing patch solutions to problems farmers are encountering rather than solving them at the root.

Case Study - Middlesex County Industrial Beef and Vegetable Farm

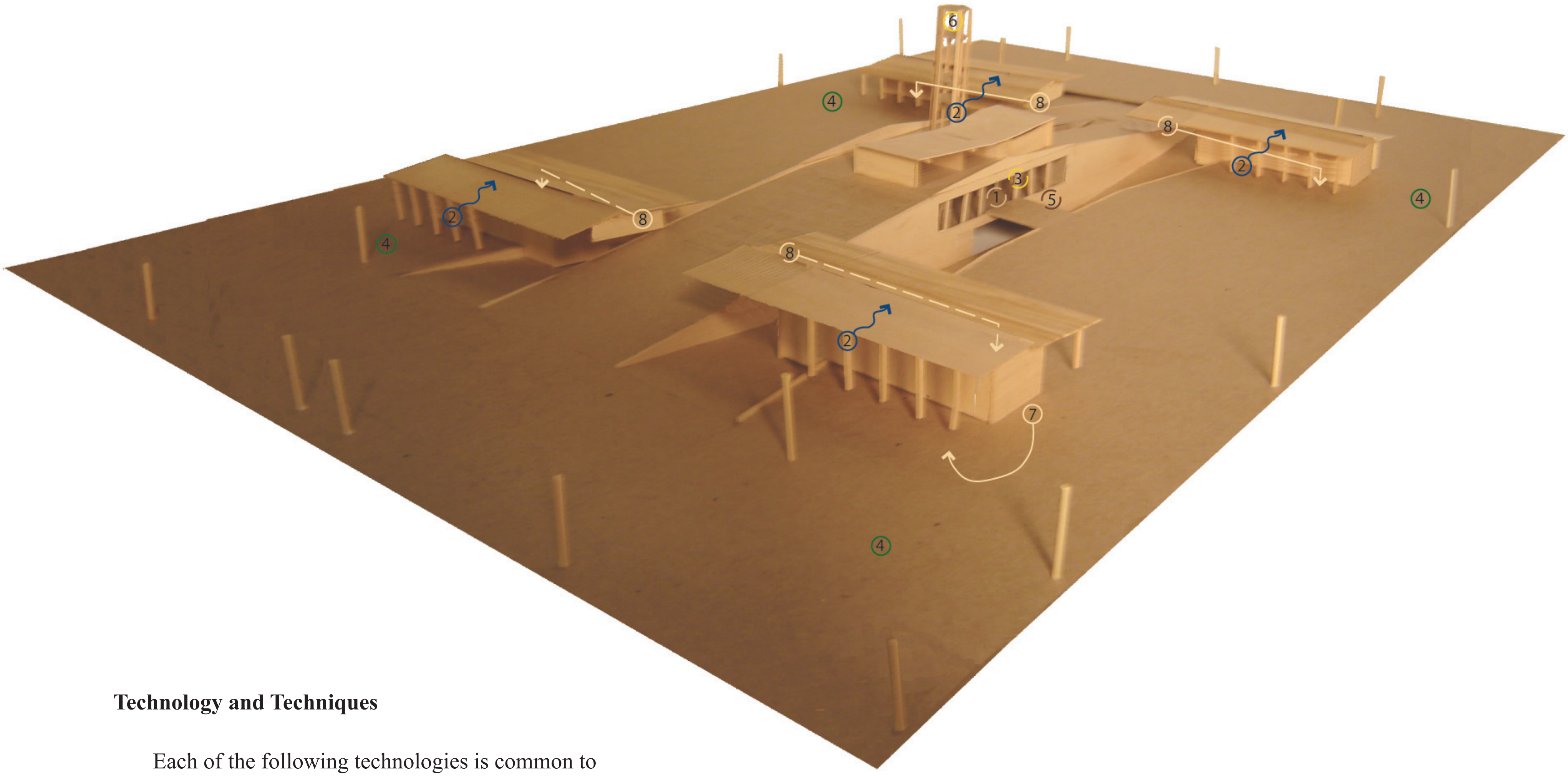
The following information is taken from an interview with an anonymous farmer in Middlesex County who operates a comparable farm to Joel Salatin's Polyface Farm, as described in the next section.

This industrial model farm is located in Middlesex County. It is 147.7 hectares (365 acres). The operation is a cow to calf operation, providing other farmers with beef animals to finish to market weight. It is also a cash crop operation. It produces 120000kg (120 tons) of hay, 42286.8 litres (1200 bushels) of white beans, 17267 litres (4900 bushels) of soybeans, 7047.8 litres (200 bushels) of corn, 45 beef calves per year as well as various vegetables, and offers the added bonus of tourist attractions. This provides this farmer with a gross income of $404.7 per year per hectare ($1000 per year per acre), mostly generated through the vegetables. The farmer has chosen to use the industrial farm model rather than the organic one because most people want perfect produce. At the local market, when a consumer asks if the sweet corn is genetically modified, this farmer responds with a quick story. He gives the consumer two options: "If I planted non-modified corn and had to spray it five times to prevent disease, or I planted hybrid corn and didn't have to spray it, which would you prefer?" The customer always responds with the second, hybrid corn. This farmer feels he cannot produce enough at the quality needed to keep up with society's demands.

This farmer uses many of the standard industrial model methods, along with some sustainable strategies. The beef cattle are fed off pastures, and whenever possible, they are moved to new grass each day. The pastures get 30 days of rest before they are grazed again. The beef animals are also fed with grain, which is purchased from the local grain elevator. This farmer has remarked that they wished that all grain feed could be produced on the farm, but the facilities for storage and preparation with industrial techniques are not within economical means. The manure which is collected from the barns is spread onto the fields. 12.1 hectares (30 acres) out of 103.2 hectares (255 acres) of croplands can be covered by manure. The other 91 hectares (225 acres) need to be fertilized by chemical fertilizers. The croplands are sprayed with pesticides and herbicides when needed, but this is done after field scouting. Field scouting tells the farmer where there are problem areas in his field and whether the problems are pests or weeds; thus, he sprays accordingly in those places. This saves him money and allows him to be careful of the environment. This farmer employs many basic sustainable methods: crop rotation, no-till planting, and computer bookkeeping. This farmer has implemented an Environmental Farm Plan, which was a program started by the Soil and Crop Improvement Association to help farmers clean up poor farm management. The Environmental Farm Plan covers only a small part of the sustainability of a farm.

This farmer felt he was doing only small part in looking after the environment. However, his definition of sustainable was "providing income over expenses to provide a living for people who are working on that farm." Farming is a business like any other, and farmers are businessmen and women who need to make a living. For a long time, farmers were among the peasant classes, and with industrial farming, it seems that an opportunity was afforded for them to make a decent living.

Fig5.10: The produce generated from the Middlesex County beef and vegetable farm.



Technology and Techniques

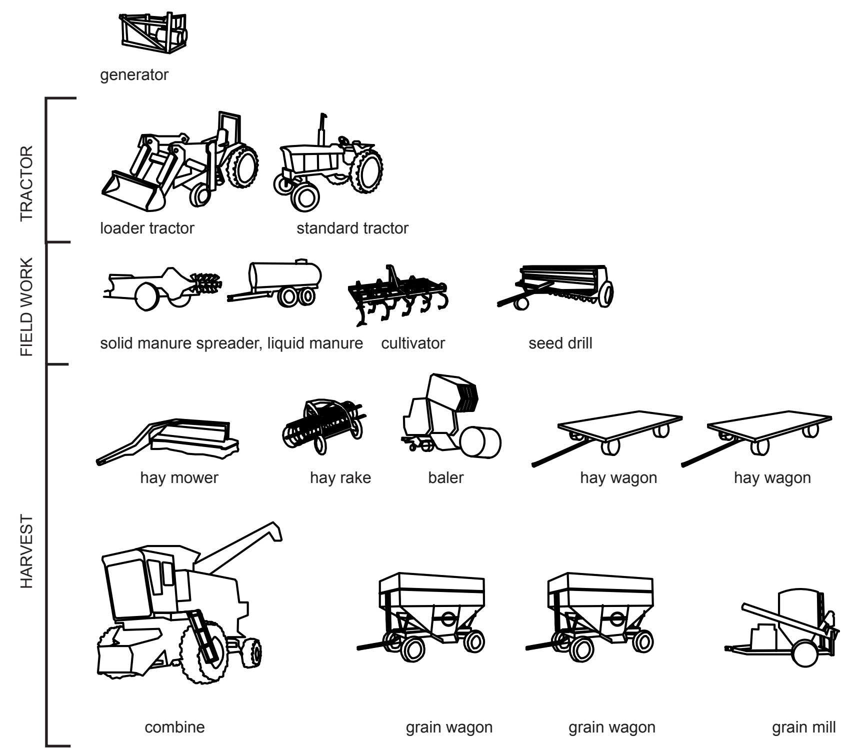
Each of the following technologies is common to contemporary industrial farming. The advantages and disadvantages of each will be discussed briefly.

Fig5.11; 1 machine storage, 2 natural ventilation, 3 biodiesel grain press, 4 pasture for manure fertilizer, 5 methane digester, 6 wind turbine, 7 robotic milking trailer, 8 grain bin and feeding system

1 **Tractors and Machinery**

Tractors are probably the most common machine found on a farm. There are 733,182 tractors in Canada, averaging 3.5 tractors per farm (Census Canada 2006). Some tractors today reach 530 ‘horses’ (John Deere 9630T model). Although tractors consume fossil fuels regularly, they are indispensable even for an avid sustainable farmer like Joel Salatin. Salatin testifies, “Henry Ford was euphoric about the great factory, the interchangeable parts – and don’t get me wrong, there are some wonderful things about that; I like my computer, my watch, my tractor – the problem is there are limits” (Salatin 2003, 4). A tractor can only do what it is told to do.

The Woven Lea Farm uses 14 machines and implements. The machines are sized appropriately for working 27 hectares (64 acres) of land. A cab tractor and loader tractor is for general maintenance. A liquid and solid manure spreader, 4-row cultivator and 4-row planter are for planting and working the land. A combine, hay mower, hay rake, grain wagon, and hay wagon are for harvesting the crops. A grain milling machine is for processing the grain into feed for the animals. Other machinery like a square hay baler, corn planter or plow would be rented from the local tractor dealership or borrowed from a neighbour. The other essential piece of machinery needed is a generator. The farm operations must continue even when the electricity goes out.



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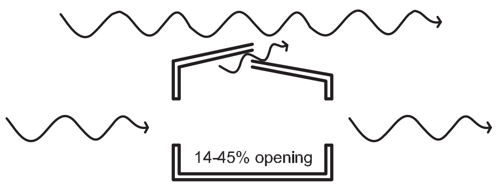


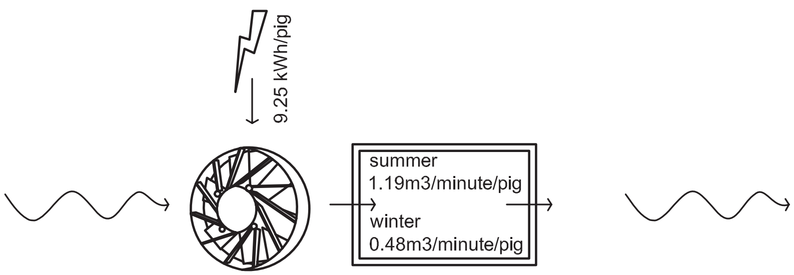


Fig5.13;

② Mechanical Ventilation

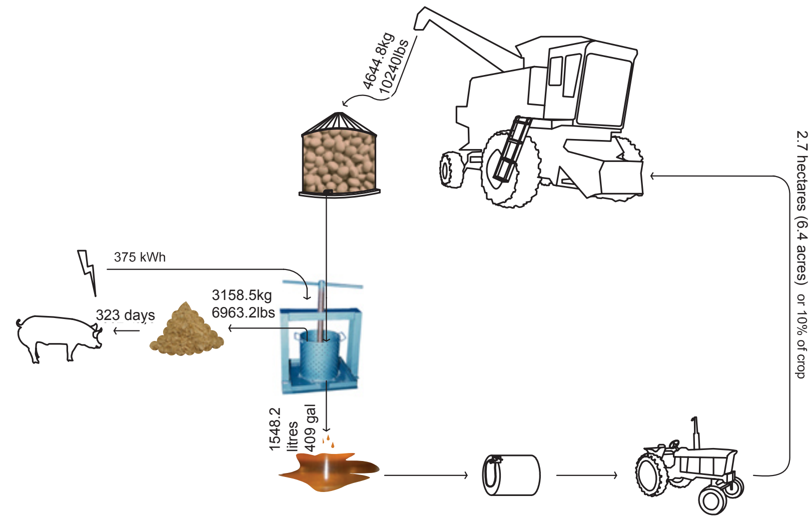
A high concentration of animals in a closed space requires mechanical ventilation. When a farmers packs animals into a minimal amount of space, they need mechanical help for ventilation and cooling. Controlled ventilation and temperature are desired to produce a consistent product most effectively. In a closed barn, ammonia tends to build up, especially with chickens and pigs, requiring a lot of ventilation and environment control. Natural ventilation is unpredictable and inconsistent. Some contemporary barns, particularly dairy barns, use natural ventilation.

Mechanical ventilation requires large amounts of energy. Woven Lea Farm uses natural ventilation by orienting the building with the long side facing the prevailing west winds. Heat generated from compost areas and other animals' barns is distributed to the house and other barns using in-floor radiant heating. Fourteen to 43 percent of the west wall can be opened during the summer. The clearstory in the barn design also assists with ventilation, acting as a vent for the rising hot air.

3 Bio Diesel

Farmers and scientists are testing the idea of bio-fuels as a substitute for diesel. Diesel-powered motors, in general, are more efficient motors; thus, most tractors have diesel engines. Vegetable oils are popular choices for bio diesel. The energy content of sunflower oil is 16,700 btu/lb as compared to diesel at 19,500 btu/lb, and is one of the most effective plants for pressing (Ritchie 1983, 15-1). Using a screw-press expeller, 75-80 percent of the potential oil is removed and costs less than $4.76 per gallon, which is the wholesale price of diesel (CNMoney.com) and makes it an economical proposition. The byproduct of the press is a grain meal which can be used for feeding livestock.

Woven Lea Farm uses 10 percent or 2.7 hectares (6.4 acres) of total cropped land (soybeans or sunflower seeds) to make bio diesel. This will produce enough gas to power the tractors to work the 27 hectares (64 acres) crop land for the year. More crop could be taken to make enough fuel for the farm vehicles as well. The press is powered by the wind turbine and only runs when the turbine is generating electricity.



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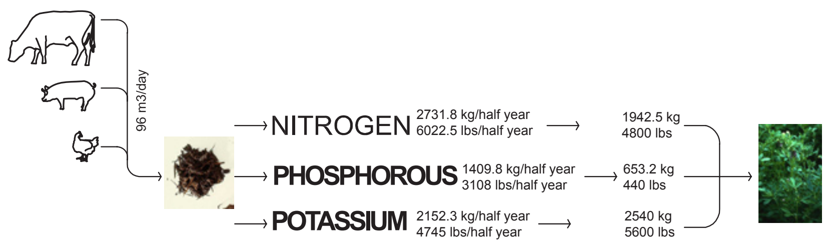


Fig5.15;

4 Manure as Fertilizer

Manure contains many nutrients and is the waste product of livestock growth. Farmers who own land will often spread this manure on the soil to supplement the chemical fertilizer put on the fields. In Canada, 2,053,963.4 hectares (5,075,454 acres) of farmland have manure applied in some form and 1,345,521 hectares (3,324,855 acres) do not use manure (Census Canada 2006). In industrial farming, many farmers are specialized and do not have a balanced mix of land and livestock, making manure use difficult.

The animals naturally spread some of the manure on Woven Lea Farm pasture areas throughout their day of grazing. The nitrogen and phosphorous spread on the fields over a half year is enough to supply the alfalfa and grasses with nutrients. The liquid and solid manure are processed further before being spread on the fields. These processes will be described later.

⑤ Methane Digester

A methane digester burns the off-gases from manure to make electricity. The byproduct of the process is liquid manure, which does not smell as strongly and can be used as fertilizer on the farmer's fields. One dairy cow has the potential to create 568 btu/hour (Ritchie 1983, 16-3). Like most commercially produced products in agriculture, digesters are currently designed to assist the large-scale farms. However, it is possible to construct home-made methane digesters which accommodate smaller herds.

The methane digester takes manure from 10 cows every 12 days. Manure is removed from the barns and dumped down the chute on the sides of the ramp into the digester located on the -5 metre level. The airtight tank has two exhausts: one for the gas produced as the manure decomposes and the other for sludge and composted manure. The gas is burned to generate electricity to run the machine and other farm equipment, and the manure is stored in the liquid manure tank before being spread onto the fields. The electricity generated from the digester powers the milking system, grain feeding, and the house needs with 43 KWh per day.

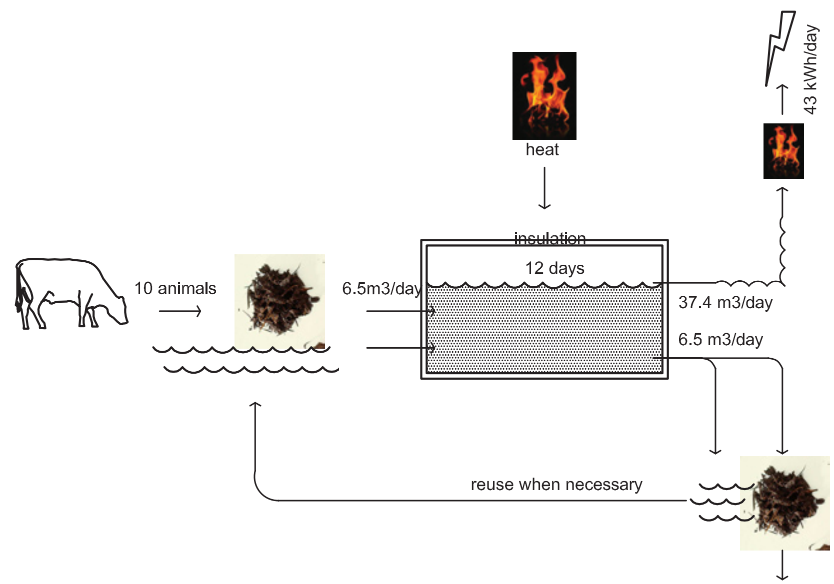


Fig5.16;

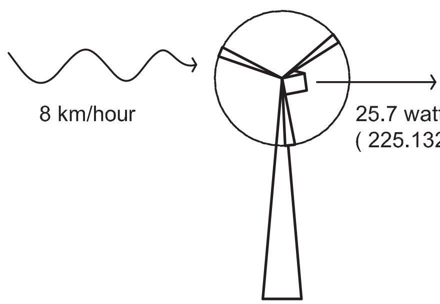


Fig5.17;

⑥ **Wind Turbine**

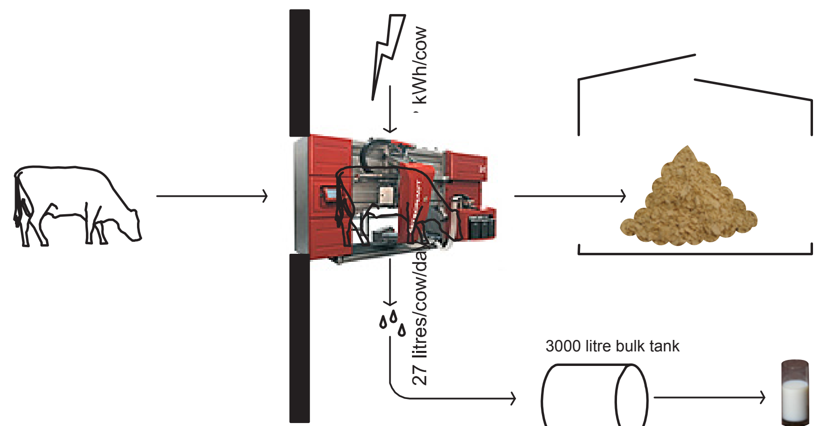
Wind turbines are used to generate electricity for farms. This new technology has been very effective for certain areas of Ontario where there are high winds. Unfortunately, most areas have only marginal wind energy potential (www.windatlas.ca, 2006). Thus, this technology is not appropriate everywhere. However, windmills have been pumping water for farms since 1860 (Ritchie 1983, 19-11). There is potential for wind to power some aspects of the farm not requiring constant power, such as water, grain mills, or heating.

The wind turbine on the top of the silo on the Woven Lea Farm powers the grain press, sump pump, and cistern system. At the average wind speed of 8km/hr, 225 kWh could be produced in a year.

7 Robotic Milking Machines

The largest and most time consuming job on a dairy farm is milking cows. One machine can milk 30-50 cows two to three times per day. Robotic milking machines are usually implemented so that the farmer can enjoy some free time. Robotic milkers are also very good management tools. They record how much milk a cow produces, whether the animal is infected, as well as many other bits information important to monitoring an operation.

The robotic milker is put onto a trailer for the Woven Lea Farm design and moved with the milking cows to each barn on the sustainable farmstead. All the doors to the barn are closed but the one the machine sits in front of. The milker is set up so that a cow must pass through it to access feed, shelter and bedding. The robotic milker eliminates the large job of milking cows and keeps accurate and detailed information about the cows on the farm. There is a milk pipeline and electricity hook-up at each barn. The milk house which houses the bulk tank, pumps, cooling, and cleaning equipment, is located on the +/- 0 level on the north east side of the ramp. The milk house can be accessed from the basement of the house. Because it is located mid-level within the house, the milk truck can empty the tank every other day using gravity as it drives down the ramp on the north side. The milk truck can also access the milk house from the +5 level and use a pump to collect the milk.



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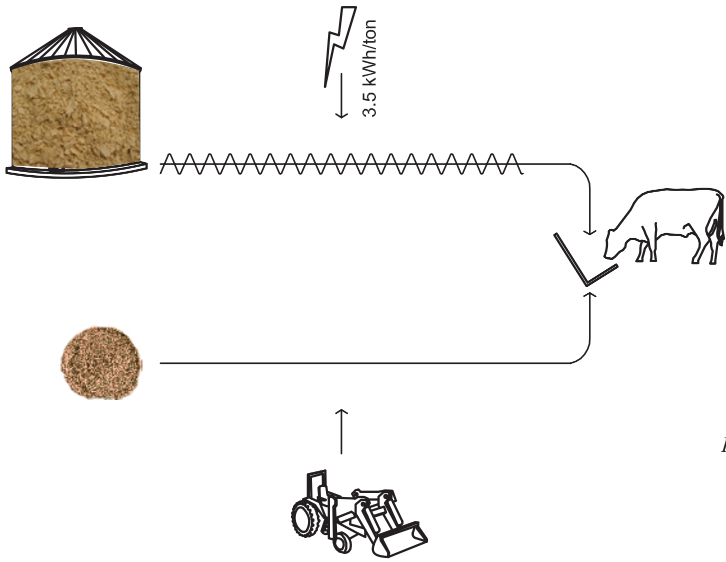


Fig5.19;

8 **Automatic Feeding System**

Grain-fed animals are a product of industrial thinking because they produce a consistent product quickly. Automatic feeding systems mix grain, oils, supplements, vitamins, and minerals together so that the animals get exactly the proper nutrients they need. However, these systems use a lot of electricity while simple gravity and man powered methods have worked in the past.

Woven Lea Farm assumes that nature has done a good job with a mixed grass and grain product and that very few supplements are needed for the feed. Round hay/grass bales are rolled out by hand in the mangers, but an auger is required to distribute the grain from the feed bin on the ramp to the manger.

NICHE FARMING

With the growing multiculturalism of Canada and other countries, niche marketing is a way for farmers to be independent, giving them the opportunity to focus on leading trends in the industry. Canada in particular has a growing Chinese population (Census Canada, 2006). Farmers can take advantage of this by growing products or raising livestock specific to certain traditional diets, such as bok choy, rice, and duck, for instance. This type of farming brings interesting issues with it. New species are introduced to the ecosystems of Canada, potentially wreaking havoc; there will also be many problems to solve associated with raising animals which are not native to the type of climate here. These markets are also lucrative in the beginning stages but they are not supply managed. These markets often become flooded after a few years and put many farmers out of business. This happened in the 1990s with emu and deer production. However, niche farming definitely can have advantages if a farmer is innovative and keeps on top of the trends.

VALUE-ADDED FARMING

Value-added farming is simply a way farmers can increase profits by providing a product which has value added to it, rather than just a raw material. An example of this is a strawberry farmer who makes pies and jams and sells them alongside the fresh berries. It could also be a product which is different or special in some way – perhaps because it is only available from a particular farmer, like a nut-based feed for pigs, or pasture-fed cow’s milk. This strategy is used by many organic and sustainable farmers to increase the marketability and price point of their products.

CERTIFIED ORGANIC FARMING

Certified organic farming is not outside the realm of industrial farming thinking. Certified organic is a branch of industrial farming; it is a variation on conventional farming practices. Thus, it is not necessarily more energy efficient, healthier, or easier. The major difference between conventional farming and organic industrial farming are chemically-based practices. Fertilizers, pesticides, and herbicides are used to maximize yields and reduce crop damage in conventional industrial farming. Genetically-modified grain varieties, which have natural pest and disease resistances bred into them, are commonly used in conventional farming. With these techniques, industrial farming has increased the yields of many crops significantly since 1937 with grain varieties that were more responsive to chemical fertilizers. Corn yield has increased by 240%, wheat by 139%, and potato yield by 214% (Oelhaf 1978, 4). Pesticides and herbicides have also decreased crop losses, thereby increasing yields again. Many people argue that by eliminating chemical pesticides, the world cannot produce enough food for everyone. "Before we go back to an organic agriculture in this country [United States], somebody must decide which 50 million Americans we are going to let starve or go hungry," (Oelhaf 1978, 5) as Oelhaf bluntly says.

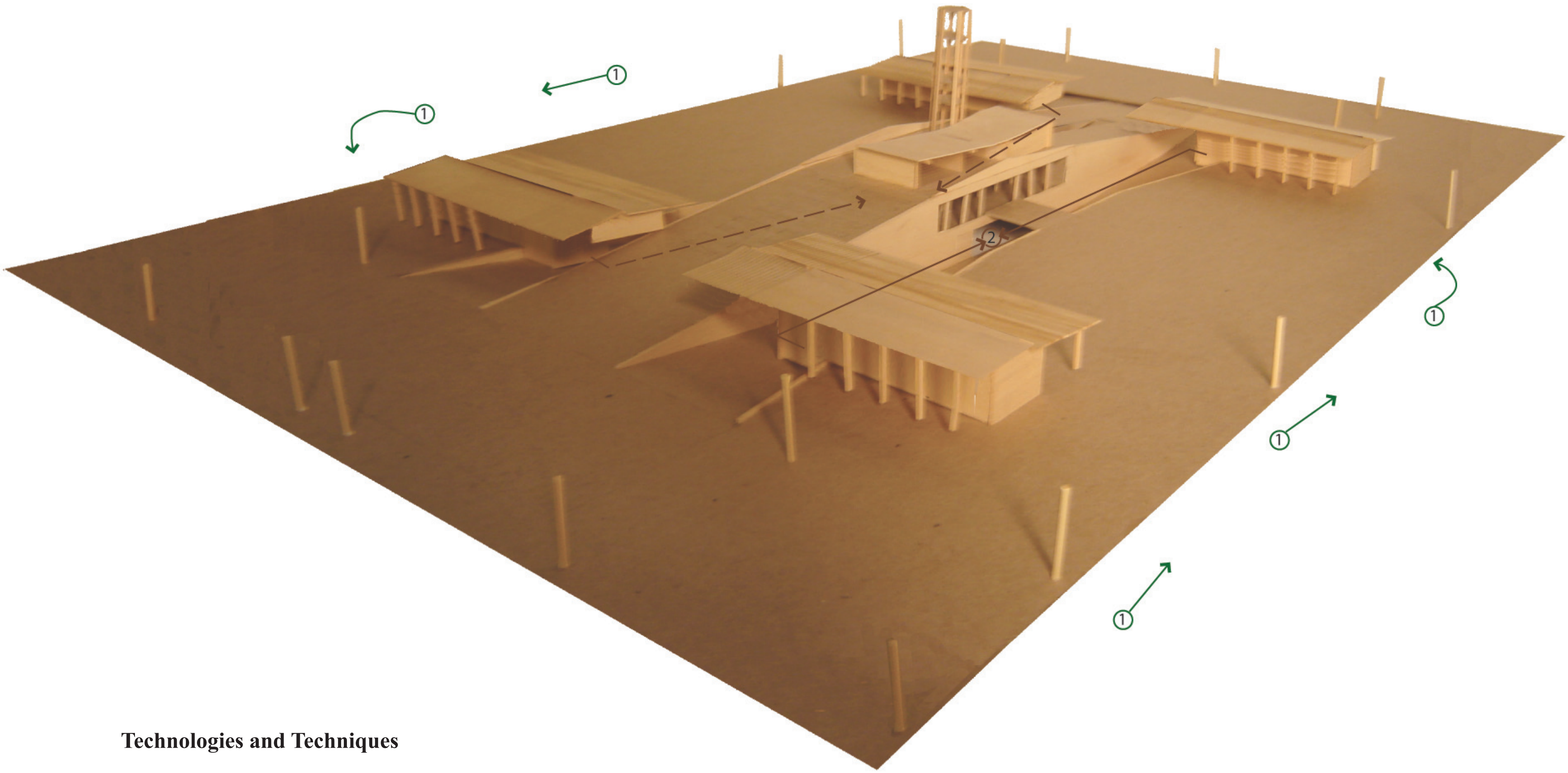
Certified organic farms make up 1 percent of Canadian farms (Census Canada 2006). Certified farmers have a "general rejection of chemical pesticides and emphasis on building a healthy soil" (Oelhaf 1978, 123). Certified organic food can be defined as "food which has not been subjected to (chemical) pesticides or artificial (chemical treatment, fast acting) fertilizers and which has been grown in soil whose humus content has been increased by the addition of organic matter" (Oelhaf 1978, 124). According to the regulations set by Canada Food Inspection Agency, when a consumer goes to the store to buy certified organic goods they are buying:

-A product which contains at least 95% organic ingredients

> -A product which comes from a farm system employing management practices that seek to nurture ecosystems in order to achieve sustainable productivity; and a farm which provides weed, pest and disease control through a diverse mix of mutually dependent life forms, recycling of plant and animal residues, crop selection and rotation, water management, tillage and cultivation
> -A product for which all inputs used in production (i.e. fertilizers, feeds, pesticides, soil amendments, veterinary treatments, processing additives or aids, sanitizing and cleaning material, etc.) were approved by the appropriate government regulatory agency for the product's intended use, where regulations govern the use of such inputs
> (Canadian General Standards Board 2006, ii)

These regulations are vague at best. There are more detailed descriptions of allowable practices and chemicals, but the goals set out by these requirements are definitely open for interpretation and are often only minimum requirements.

Certified organic farmers have made a mentality shift. Certified organics are not necessarily more beneficial than conventional farming in the areas of energy, environment, or economics. Certified organic is not necessarily more energy efficient since driving a tractor to take out weeds uses just as much energy as spraying herbicide. The use of some chemicals or the improper use of biological chemicals can have detrimental effects on the environment, just as conventional farming does. Certified organic farming is more expensive to produce and more expensive to buy, therefore a switch to certified organics is not motivated by money. Although "[organic farmers] might not make a lot of money, they are proud to feel they are leaving the earth a better place" (Oelhaf 1978, 147). The important aspect of certified organics is the desire to work sustainably. Certified organic farming methods may or may not be better than conventional techniques, but it is a step in the right direction towards sustainable farming.



Technologies and Techniques

The following practices are common practices on organic farms.

Fig5.20; 1 crop rotation and pest management, 2 compost

Biopesticides

Biopesticides are methods of reducing crop losses caused by destructive pests. Using nature as an example, diverse plantings encourage certain beneficial pests to inhabit the fields. These beneficial pests are predators to the destructive pest. For example, aphids are a common problem in soybean growing, or corn borer in corn growing. By planting species or making habitats for ladybugs, spiders, birds, frogs, or toads, their populations increase in the area and they keep the aphid population under control in the fields. This process is a delicate balance because some of these predators can also become problems. On occasion, natural organic pesticides or approved chemical pesticides must be used.

Plowing

Plowing the field to remove weeds is an organic method of herbicide. This method, although it works well in cultures where manual weeding is done, is very energy intensive when done with a tractor. A successful organic herbicide method has not been established for certified organic farmers.

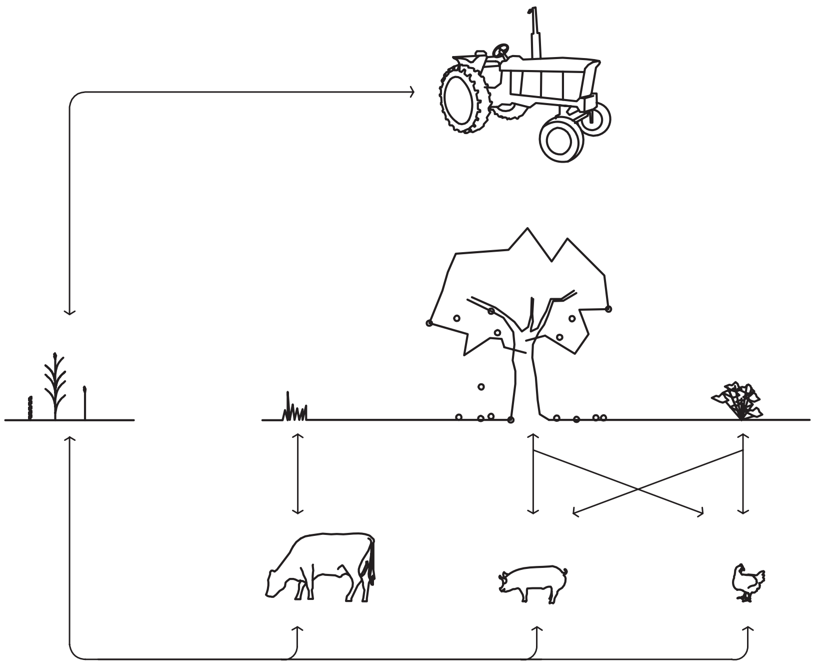


Fig5.21;

Polyculture

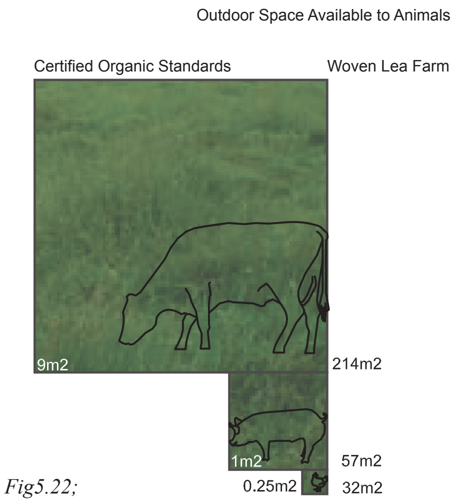
This method involves many diverse species planted in an area rather than the industrial monocultures. The basic implementation of this involves livestock and plants co-habiting to provide nutrients for each other. Polyculture is one of the “hundreds of such botanical lessons about us. Look long enough and the methodologies of nature become clear” (Mollison 1988, 45). This method requires knowledge of native species and regional ecosystems. Middlesex County is natively a deciduous forest of nuts and berry trees, with small patches of open space for low understory plants. A sustainable system would mimic the small patches, plant native trees, and use a perennial understory crop (Piper 1992, 139).

Woven Lea Farm is a diverse farm, including the main cash crops of dairy cows, and pigs. In addition, chickens, veal, soybeans, sunflowers, corn, wheat, and alfalfa are grown to grow the main crops. The other alternative crops are vegetables, diverse grass in the pastures, a deciduous woodlot, a fruit orchard, nut trees, berry bushes, and marsh lands. There are many relationships between the plants and animals on the farm. In the pastures, the pigs eat the nuts from the trees, and the cows don’t touch them. The variety of grasses in the pastures appeal to both the cows’ and the pigs’ appetites. The various crops provide a varied diet to the farmer and extra produce to sell. The bushes along the fence lines provide animal grazing, wind breaks, and aesthetic benefits.

Animal Welfare

Part of the organic movement was a concern for animal welfare. The organic regulations state that animals must have access to a certain area of outdoor space (Canadian General Standards Board 2006, 17). However, often organic farms do not encourage their animals to use this space, as described by Michael Pollan in the book 'Omnivores Dilemma.' True organic philosophy goes beyond animal welfare and encourages animal quality and health. Healthy animals are raised by being fed healthy food and through the maintenance of a healthy inside and outside environment.

The barns on Woven Lea Farm can be completely opened and allow free range for the animals on 1.6 hectares (4 acres) of pasture land on any given day in the summer and 0.8 hectares (2 acres) in the winter.



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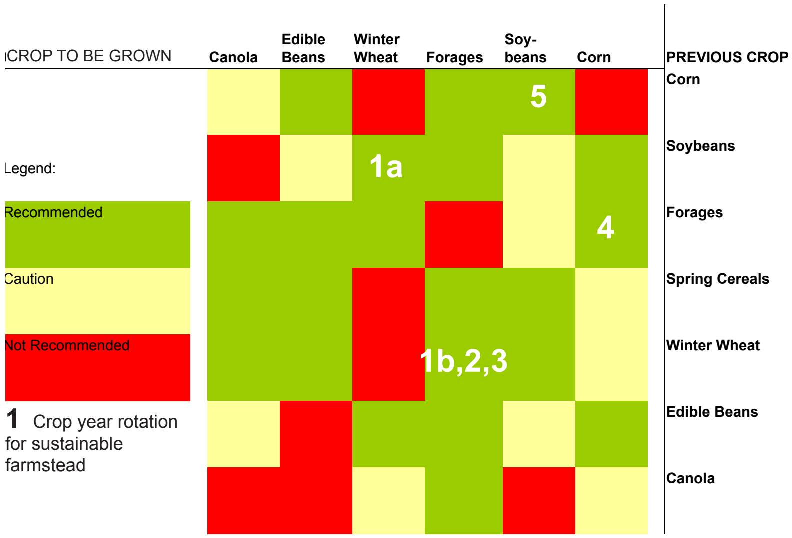


1 Crop year rotation for sustainable farmstead

① Crop rotation

When a single crop is planted on the same field year after year, the nutrients in the soil are depleted and crop yields are reduced, unless chemical fertilizers are applied. Keeping the same crop on the field also encourages pests to infest and damage crops. Monoculture non-rotating crops do not act like an ecosystem to maintain environmental health naturally. Many farmers have begun using crop rotations to restore soil health, to take care of the limited resource that is our soil, and to maintain the high crop yields. Farmers have found that legumes are good crops to precede corn because they leave a lot of nitrogen in the soil; this is essential to growing corn. The chart to the left recommends and discourages different combinations of crop rotations.

The crop rotation on the Woven Lea Farm provides food for the animals in the winter, and bio diesel to operate the farm. The rotation is as follows; the first year's winter wheat is harvested early in the season and planted with hay, year two and three is hay, year four is corn, year five is soybeans or sunflowers, which alternate cycles, year five (or year one) is winter wheat leading into hay again. There are five small fields of 5.4 hectares (12.8 acres) each. Each field uses this rotation, but each small field is in a different year, allowing each crop to be harvested every year.

Fig5.23;

② Compost as Fertilizer

Composting manure rather than directly applying manure to fields reduces potential contamination, odours, larvae, and stabilizes nutrients. Composting requires airflow, temperatures of 40-55 degrees Celsius, three months of time, moisture levels of 50-60%, turning, and bulking materials which release carbon in the process (www.omafra.on.ca 2005, Howard 1943, 49).

The manure collected in the barns on the Woven Lea Farm will be composted before it is put onto the fields of the sustainable farmstead. The compost pile is hidden on the -5 level with the methane digester. The 33 945m3 of compost collected over the year will provide most of the nutrients required on the land. The system is naturally balanced.

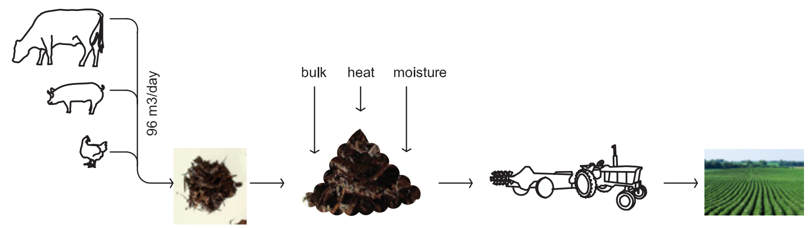


Fig5.24;

ORGANIC FARMING

Certified organics is only a small part of the philosophy of organic farming. The goal of organic farming is to produce a healthier food for consumers and reduce environmental impact. Certified organic has become a mere marketing tool for farmers and processors. The supermarkets almost always offer certified organic foods. This highly regulated label has reduced the organic ideals to simple and minimal requirements. Certified organic farmers do not always buy into the principles of the sector, but are mostly concerned with the bottom line.

The organic movement emerged from many writers. In 1943, Sir Albert Howard compiled many of these environmentally friendly practices into a lifestyle of organic farming. Howard's idea of optimal agriculture begins with healthy soil, and leads to healthy animals, quality food, healthy consumers, healthy finances, and the positive future of civilization. His writing tries to instill a moral obligation to the earth and its inhabitants (people and animals). His writings do go into the technical aspects of making proper humus for the soil, but he is principally trying to make a case for a healthy farming practice by following the example set out by nature. Howard observed nature and the practices of the peasants of China and India. He states that "the peasants of China, who pay great attention to the return of all wastes to the land, come nearest to the ideal set by nature" (Howard 1943, 20). These ideals are the basis of many organic farmers, like Joel Salatin, who has written extensively on the subject of organic farming.

A true organic farmer lives a certain lifestyle which revolves around his organic philosophies. Rudolf Steiner's bio-dynamic philosophy encourages self-sufficient, owner-managed, and diverse farming. His theories apply to society as well, where a "farmer should make a life-long commitment to his own piece of earth, with which he will establish a close personal relationship" (Oelhaf 1978, 117). Organic farmers have a mentality whereby they feel morally obligated to the environment and society.

Case Study - Joel Salatin's Polyface Farm

Polyface Farm in Virginia is an alternative agricultural farm operated by Joel Salatin and his family. The farm is described as alternative because he chooses not to farm according to conventional industrial practices, nor is he part of the "organic," or any other, trend. Polyface Farm is a farm designed to mimic nature. The animals, plants, and people that live on this farm are part of a well-designed ecosystem that is monitored and tweaked constantly. "…This is all information-age stuff we're doing here. Polyface Farm is a postindustrial enterprise" (Pollan 2006, 191). Polyface farm is managed through close management of the ecosystem. Salatin must constantly monitor his ecosystem with information he gathers and external sources.

The farm is based on working with the sun's energy. This energy is gathered by the carefully maintained grass pastures and woodlot and enters the Polyface Farm's ecosystem. Because Salatin's farm mimics nature, the animals are healthy: they are operating the way nature intended. The figure to the right describes the process of Salatin's farm. Fifty to 80 beef cattle graze on 0.1 hectare (¼ acre) of grass pasture, and each day they are moved to a new 0.1 hectare (¼ acre) of grass, confined by flexible electric fencing. Three days following the grazing process and once the maggots in the cattle manure have grown but not hatched, the laying hens are set into the pasture to feed on it and disinfect it at the same time. This rotation continues through the grass growing season. Meanwhile, the broiler hens and turkeys are fertilizing other grass fields with their manure. These grass fields are harvested for feeding during the winter months. Throughout the winter, the beef cattle and hogs are inside barns on beds of wood shavings sprinkled with corn. The shavings and manure build up over the winter. When the cattle are let out of the barn in the spring, the pigs are put into the cattle barn. Pigs naturally root through the earth, and with the fermented corn hidden in the 1 metre deep straw bed, they naturally aerate the manure and turn

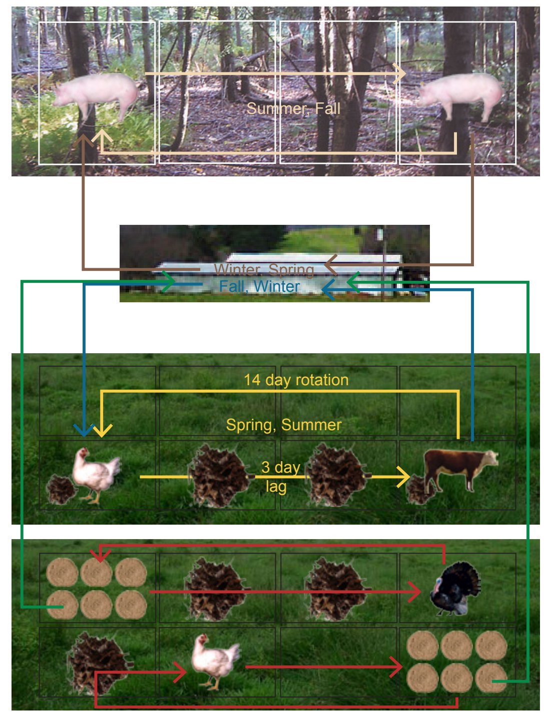


Fig5.25; The rotaion system of Joel Salatin's animals is described by him as a dance.

it into excellent compost. During the summer, the pigs are fed by grass pastures and forest savannahs cleared by the pigs and Salatin. Through these animals, the grass turns the sun's energy into delicious food that Polyface Farm sells on-site. Joel Salatin's model had a large influence on the Woven Lea Farm; it is a real example of the application of ecosystem thinking in farming.

The farm produces 30 000 dozen eggs, 10 000 broilers, 800 stewing hens, 11 339.8 kg (25 000lbs) of beef (50 animals), 11 339.8 kg (25 000 lbs) of pork (250 hogs), 1000 turkeys, and 500 rabbits, all from 40.5 hectares (100 acres) of grass and 182.1 hectares (450 acres) of woodlot. "They are all complementary, symbiotic and synergistic. We've taken that acre of land and instead of producing $200 or $300; we produce $4,000 to $5,000 per acre" (Salatin 2000, 4). These numbers show that Salatin's alternative model is economically and sustainably viable.

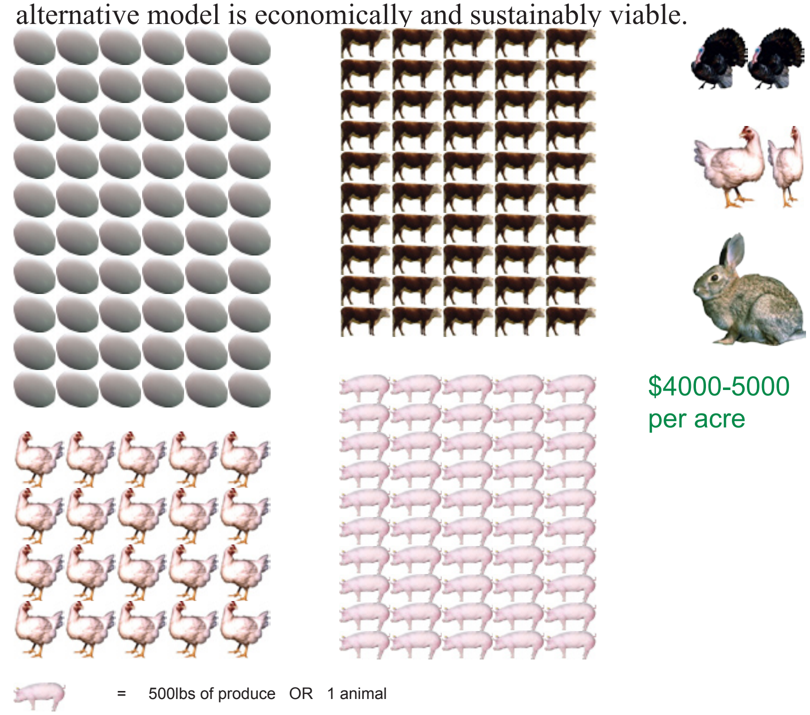
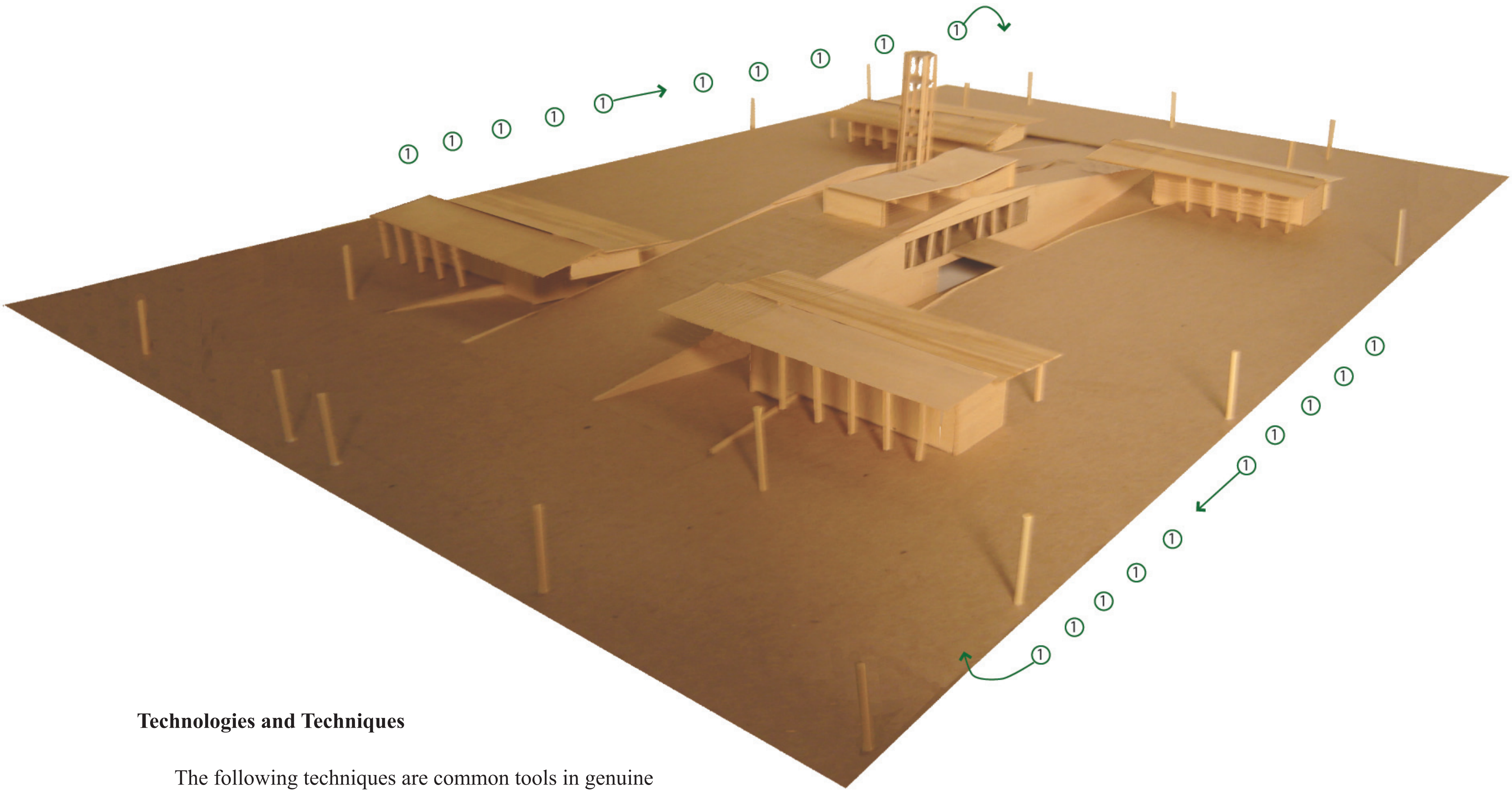


Fig5.26; Joel Salatin does intense farming with nature and produces large amounts of food.



Technologies and Techniques

The following techniques are common tools in genuine organic farming.

Fig5.27; 1 pasture rotation

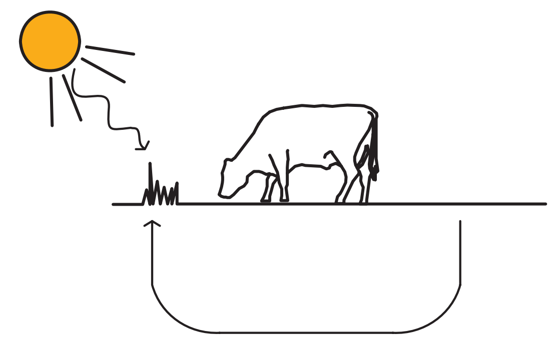
Local scales

Although not addressed in this design, farming needs a local food system to remain energetically, socially, and economically sustainable. Many farmers wish to market their goods to their neighbors; however, regulation does not allow this. Milk cannot be sold outside of the Ontario Milk Marketing Board, and animals must be killed by certified abattoirs. A farmer is required to send his produce away from his neighbors due to regulations; this increases energy use and reduces community relationships. By shipping through large infrastructure, excessive energy is used and money leaves the small communities to go to large grocery stores and oil companies.

Closed Ecosystems

Closed ecosystems mimic nature. The only energy brought into the system is solar energy; it is used to power the system. The simple and most practical application of this is through nutrient management, where animal waste is used as fertilizer on the fields which feed the animals. No external feed or fertilizer is brought to the farm. Other applications involve net-zero energy, biopesticides (natural species pesticides and herbicides), and using only local food supplies to boost local economies.

There are many closed ecosystems on Woven Lea Farm. The animals and the crops provide nutrients for each other and the technology provides electricity for the farmstead from free internal sources. Taking the ecosystem further are the chickens. Salatin remarks that birds always follow herbivores in nature: this is because the birds eat the grubs which grow in the herbivore's manure and thus reduce the diseases and irritation to the herbivores. Chickens improve the Woven Lea ecosystem by increasing the health of the pastures and animals. The whole farmstead is a complex ecosystem, exporting only raw goods for processing and consumption.



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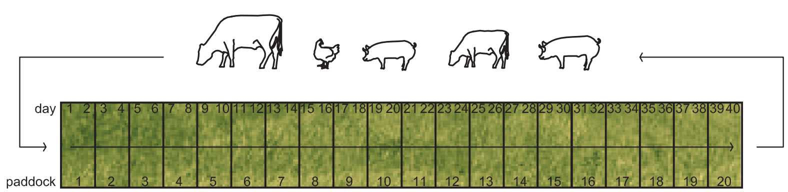


Fig5.29;

1 Pastures and Grass Feeding

Livestock naturally feed on grass and green matter in woodlots. Organic farming attempts to return to these methods, making the animals and the given land resources more efficient. Grass pastures are special mixes of grasses, alfalfa, clovers, and other grass-like plants. Grass pastures should not be grazed more than two days in a row, after which production of milk or fat is reduced and the health of the grasses is compromised. A 14 to 30 day rest period is needed between each grazing (Voisin 1988, 21). A carefully orchestrated 'dance' is used to move livestock from one pasture to another at the most efficient rate.

This rotational grazing system is adapted to Woven Lea Farm. Animals spend 2 days on each paddock and the paddock gets a 20 day rest period before it is grazed by the same animal again. The pastures have a variety of plants for the pigs and cows to feed on. These include grasses, trees, nuts, and berry bushes. Native prairie plants are chosen from the legume, cool season, warm season, and sunflower families. The pasture also contains native nut trees such as chestnut, oak, and hickory. The fence rows contain fruit and berry bushes to encourage other animals into the ecosystem of the Woven Lea Farm.

SUSTAINABLE FARMING

Artisanal, industrial, certified organic and organic farming are the four major categories of farming. None of these methods seem to have solved all of the farmer's problems, and many create more problems. There are many effective methods described above and they are implemented into the sustainable farmstead described above. The sustainable farmstead, however, defines sustainable in broader terms than just with regard to the environment and energy. It is essential that this design be economically reasonable, and culturally appropriate. It does not conform to only organic or industrial standards; in addition, this design has a responsibility to the earth, the people it feeds, the farmer it economically supports, and the culture of farming itself.

Woven Lea Farm combines many sustainable philosophies and organic methods with many industrial ways of thinking and the existing infrastructure. The farm works with the current culture of farming, but imagines what the future of farming might be like. McMinn and Polo realize that

> traditional approaches to architecture [and agriculture] often fail to address the needs of an advanced post-industrial society with particular expectations of the built environment [or ease of work]. The challenge is to distill those elements of the vernacular that addresses the issue of sustainability, both attitudinally and symbolically, without sacrificing the standards of health, safety, and comfort that form the basis of contemporary technologically advanced building (McMinn and Polo 2005, 7).

We are unable to go back to the traditional and energy-efficient farming of artisanal ways. Society has seen and expects the conveniences of the modern world. Thus, in the vision of the Woven Lea Farm, technologies from industrial farming, family farming, and organic farming are used in conjunction with each other in order to create an energy efficient and sustainable farm.

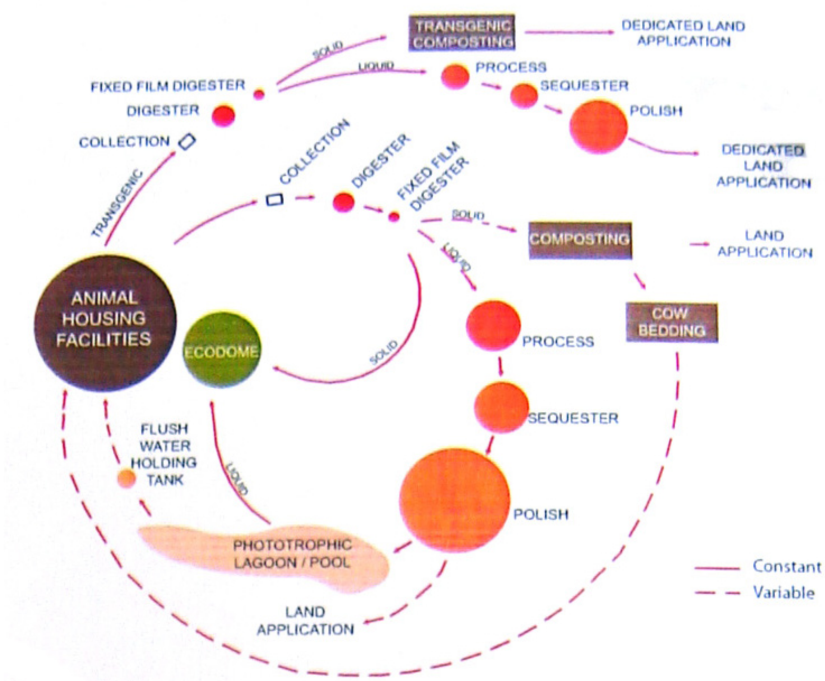


Fig5.30; Systems diagram of the manure cycle at the Elora 2050 Dairy Research Farm..

Case Study – 2050 Elora Dairy Research Station

The University of Guelph is known for its research and commitment to the agricultural sector. On the various campuses, there are designated areas to test, educate, and research new techniques relating to feeding, technology, and energy. The newest project is a research centre in Elora, where sustainable technologies will be tested for application on various scales. The main focus is on dairy farming using a 300 cow herd and an 80 cow herd. The areas of research stemming from dairy are multidisciplinary consulting, dairy technologies, diary co-products, co-products from organics, energy, emissions monitoring, and public awareness.

The research centre's goal is to establish a new system of sustainable animal agriculture systems. This project is evaluating industrial technology and not looking at alternative or organic methods of farming. Some of the technologies that are implemented are a methane digester, lagoon water filters, bio-security planning, central farm efficiency planning, a greenhouse, passive ventilation, solar panels and solar orientation, and a wind turbine.

The research centre is being designed by Baird Sampson Neuert Architects in Toronto. The main role of the architect in this project is to design a public and private interaction system and to facilitate coordination between all the disciplines of the design. There is a raised corridor throughout the farm which allows the public to see and access the barns, milking parlour, and other systems. This corridor also keeps them away from harm, away from the animals and out of the way of the farm's activities, while at the same time provides easy access to the farm. The second major role is systems co-ordination. Along with farm researchers in various fields, energy, space, manure and wastes are evaluated and the architecture brings them together in a coherent and simple manner. Architecture plays several other roles as well: the main entrance, bio-dome and some aesthetics are very important as this is a public education place as well as a working farm.

This project is very technologically oriented and sustainability in this project is achieved through technology. These systems may work at this large scale, but are they effective to an average farmer running an average farm? The scale of the project is encouraging large-scale farms, a concept which is distant from the family farm that most people want to operate. The 2050 Elora Dairy is a net producer of energy. However, is it achieved using the best possible methods for the environment, the soil, the farm culture, or the farmer? This thesis could define sustainable in this manner, but it does not. Woven Lea Farm learns from all theories about farming and aims to combine them in new and unique ways.

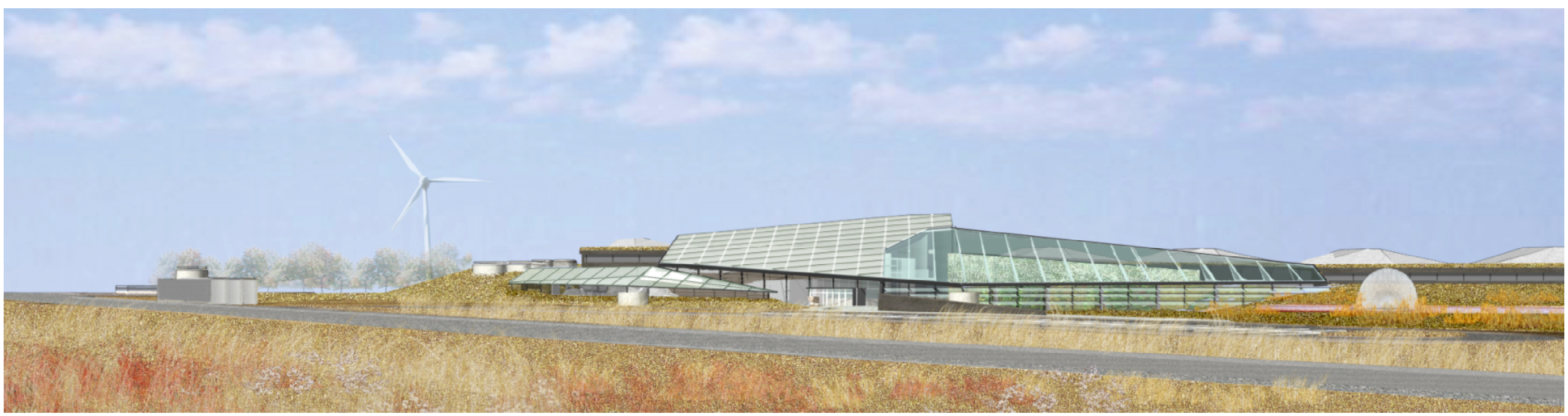
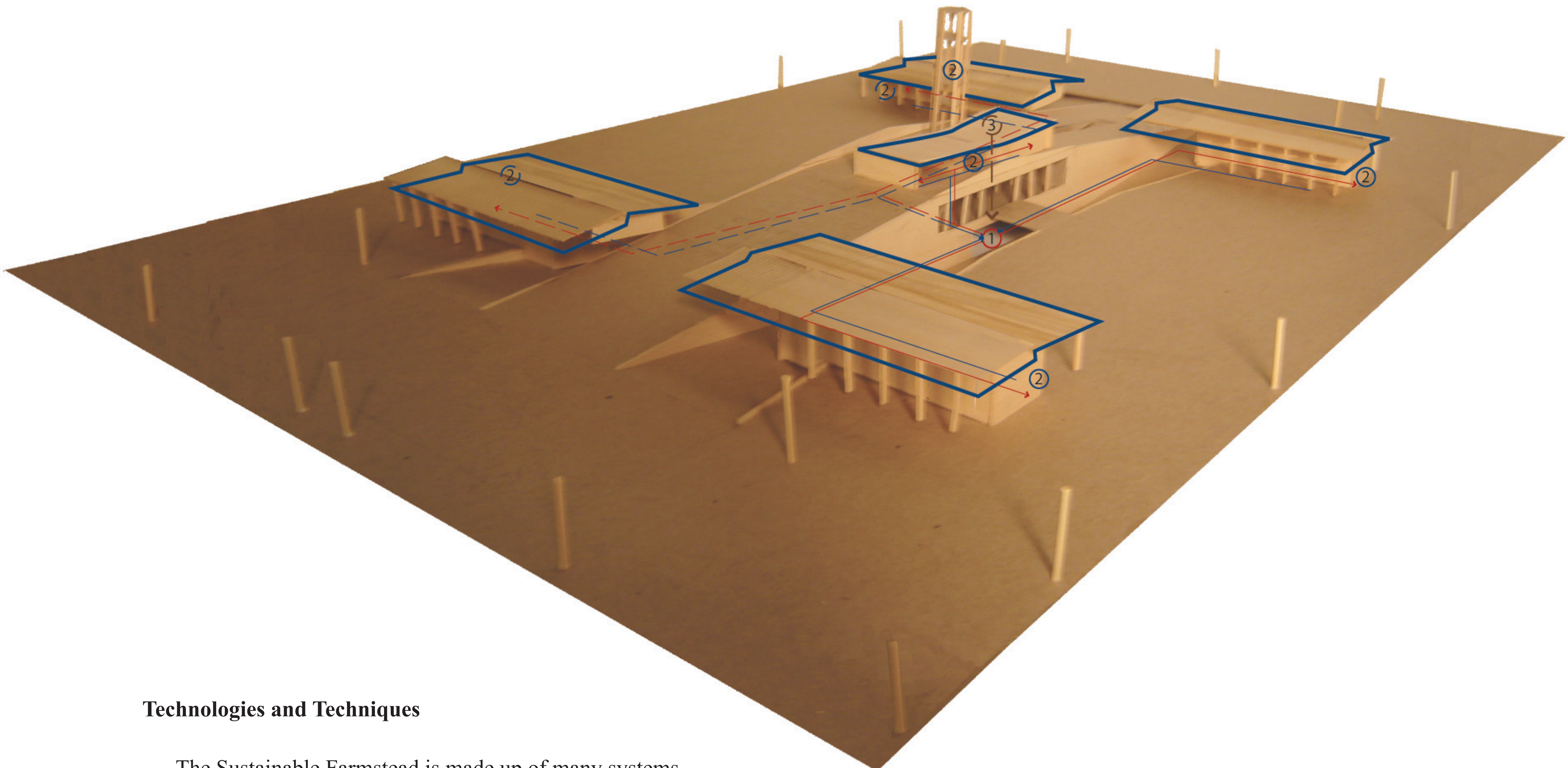


Fig5.31: Computer rendering done by BSN Architects of the Elora Dairy 2050 Research Station.



Technologies and Techniques

The Sustainable Farmstead is made up of many systems described from previous approaches and those that follow are other unique solutions to the problems of farming.

Fig5.32; 1 radiant floor heating, 2 water collection, 3 house waste disposal

① Heating and Cooling

Animals and compost generate excess heat on a daily basis. In the winter animals are able to keep the barn warm with only their body heat, aside from sows and chickens. Compost also generates heat in the winter. A pile of compost will not freeze on the ground during the winter because it generates heat as it decomposes. In the summer, heat must be removed from the barns to keep the animals cool, and compost can act as a heat sink for this excess heat.

Woven Lea Farm distributes heat using a radiant floor system. In the winter, heat is taken from the compost pile, milking cattle barn, and finishing pig barn, and redistributed to the house and the sow and chicken barns. In the summer, excess heat is removed from the barns using the basement as a heat sink.

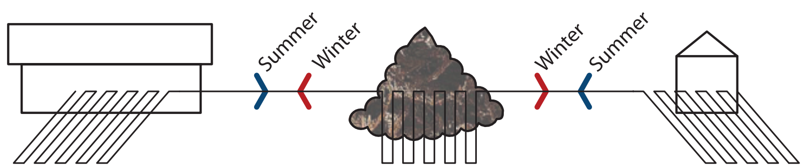


Fig5.33;

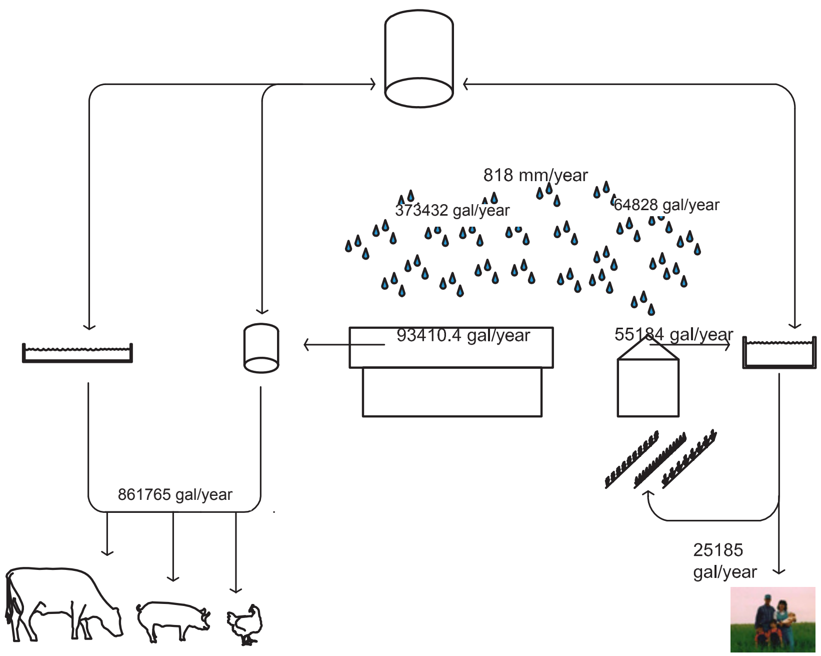


Fig5.34;

② Water Collection and Distribution

Water usage in Middlesex County is not a major concern, as there is no lack of water; water quality is more important. Runoff from farmer's fertilized fields and manure areas is contaminating many ecosystems in the area.

Water on Woven Lea Farm is collected and filtered when needed. Water which runs down the downward ramps is contaminated by the manure remaining on the ramp. This water is pumped either into the methane digester, or the regenerative wetlands. Water from the barn roofs is collected and stored at each barn for use in the watering system. Any excess water is pumped to the cistern in the tower for use later as the barn cisterns get low or delivered to the water troughs in the pastures. Water is also collected from the house roof and stored in a pond, with any excess being stored in the cistern. The water collected is used in the house and for watering the gardens.

Surface	Area (m2) (m2)	Percipitation (m/year)	Rain Volume (m3/year)	Rain Collected (gal/year)	(litres/year)	Water Requirements (gal/year)
Cow Barn	432	0.818	353.4	93358	353398	540200
Heifer Barn	432	0.818	353.4	93358	353398	292000
Sow Barn	432	0.818	353.4	93358	353398	16425
Hog Barn	432	0.818	353.4	93358	353398	109500
Chicken coop	16	0.818	0	0	0	2190
House	300	0.818	245.4	64828	245400	25185
TOTAL	2044	0.818	1659	438260	1658992	886950

③ House Integration

The farmhouse is an essential part of the Woven Lea Farm and thus it must be integrated into the farm system. It is located on the top of the ramps for sun access and has a clear view over the whole property. Household wastes such as compost from the kitchen and bathroom toilet are deposited into the compost pile in the basement for use on the fields and the vegetable gardens. Waste water is filtered in the wetlands and the wetlands also provide a skating pond in the winter.

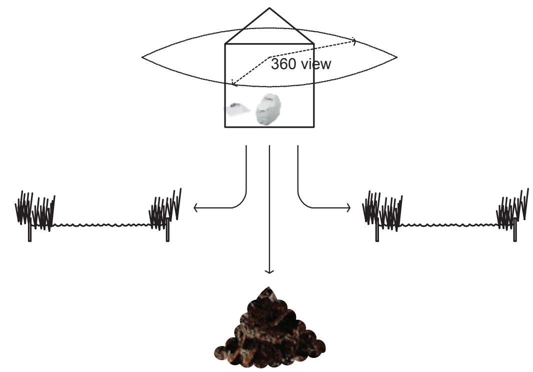
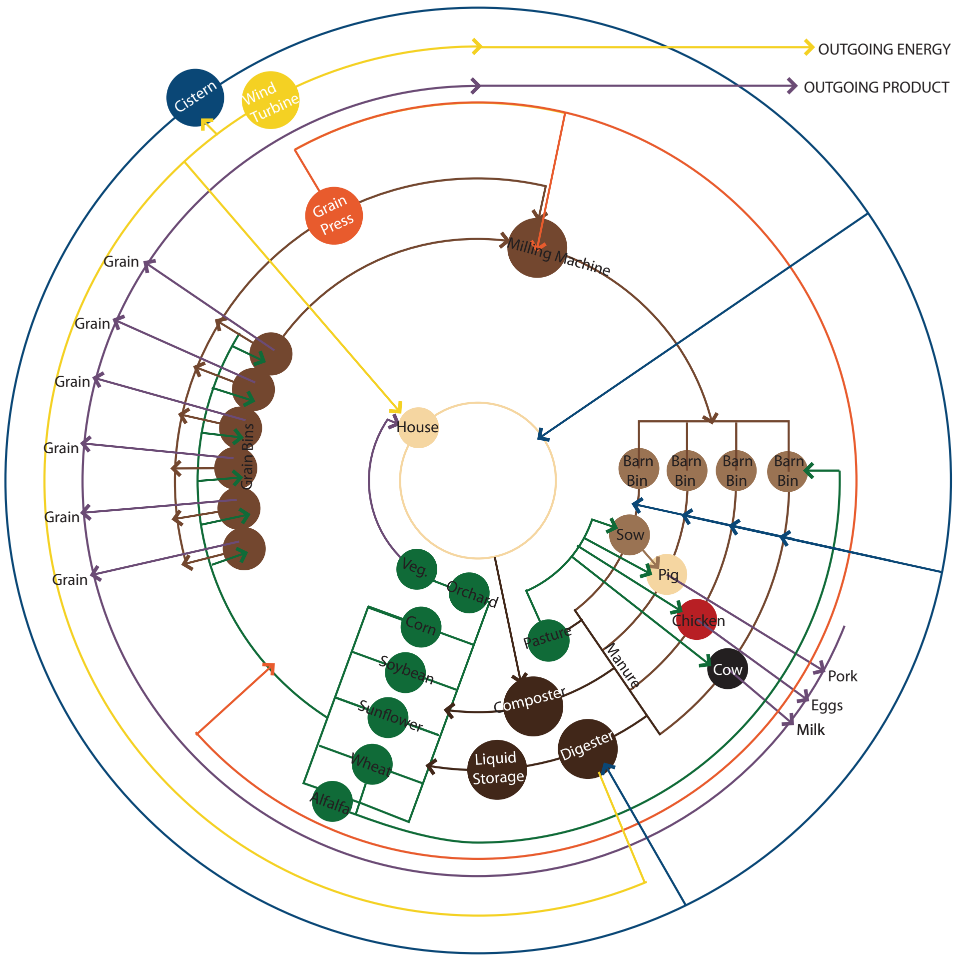


Fig5.35;



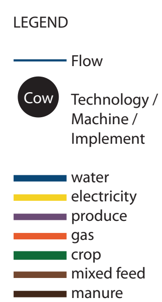


Fig5.36;

Ecosystem Planning

Woven Lea Farm is a complex ecosystem, which creates a self-sufficient farm. It not only uses architecture and technology, but nature as well. When nature is brought into farming, complex understanding, planning and management is needed. The diagram to the left describes all these processes and the relationships between them. The design imports very little to no outside products. It exports the saleable items to produce an income for the farmer.

Intensity and Efficiency

The Woven Lea Farm maximizes the 150 acres it occupies. The farm produces 324000 liters of milk, 39000 kg of pork, 6083 dozen eggs, and 200 stewing hens, and 5000kg of veal. Assuming that all the feed is used on the farm, the Woven Lea Farm produces an income of $8902 gross per hectare ($3620 gross per acre). These numbers are comparable to Joel Salatin's farm. By creating an ecosystem design, the 60.7 hectares (150 acres) can be used more efficiently to create a better lifestyle for the farmer.

= 27 litres per day X 300 days per year = 8100 litres per year X 40 cows = 324000 litres

324000 litres X $1.50 = $486000

= 1 calf per year X 40 cows = 40 calves X 1/2 bulls = 20 veal animals X 250 kg = 5000 kg

= 5000 kg X $2.00 per kg = $10000

= 130 kg meat X 300 pigs per year = 39000 kg

= 39000 kg X $1.20 per kg = $46800

= 1 egg per day X 365 days = 365 eggs X 200 chickens = 73000 eggs per year / 12 = 6083 dozen eggs

= 6083 dozen eggs X $1.44 per dozen = $8760

= 200 stewing hens per year X $2.15 per bird = $430

= $486000 + $10000 + $46800 + $8760 + $430 = $542990 / 150 acres = $3620 per acre

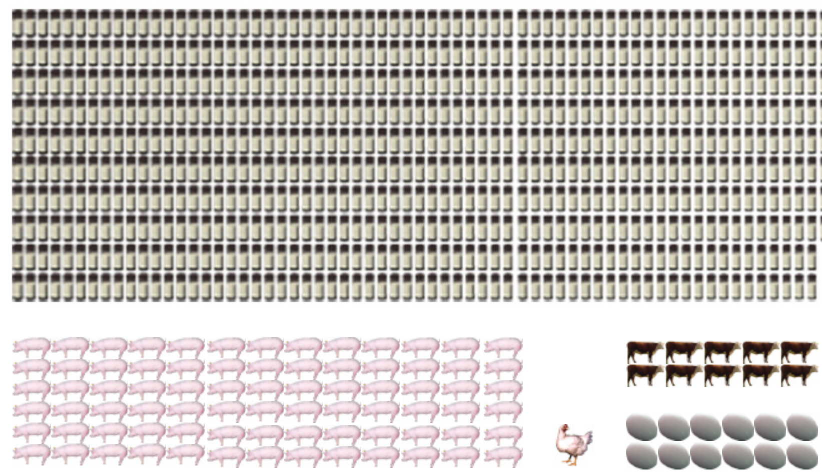


Fig5.37; = 500 units of produce OR 1 animal

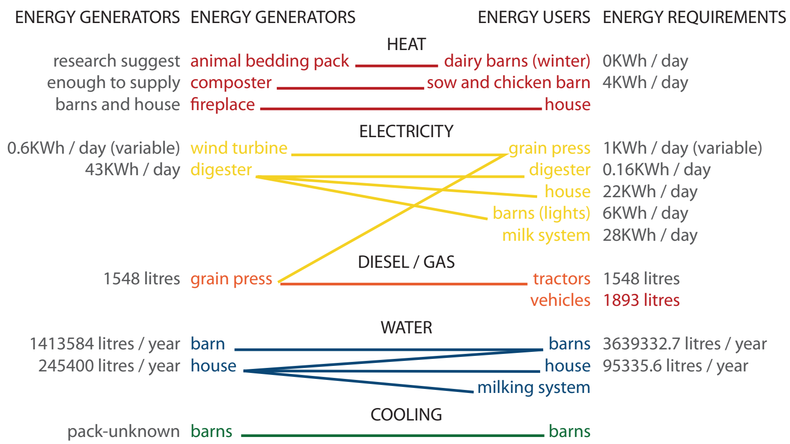


Fig5.38;

Self-sufficiency

The Woven Lea Farm is relatively self-sufficient. It does not rely on the electrical grid or the local gas company to power the systems of the farm. Very little products, aside from some household needs, are imported onto the farm. All of the energy is generated from the 150 acres. This includes the heating and cooling of the barns and houses. The Woven Lea Farm does, however, require the agriculture distribution system to sell all the products of the farm.

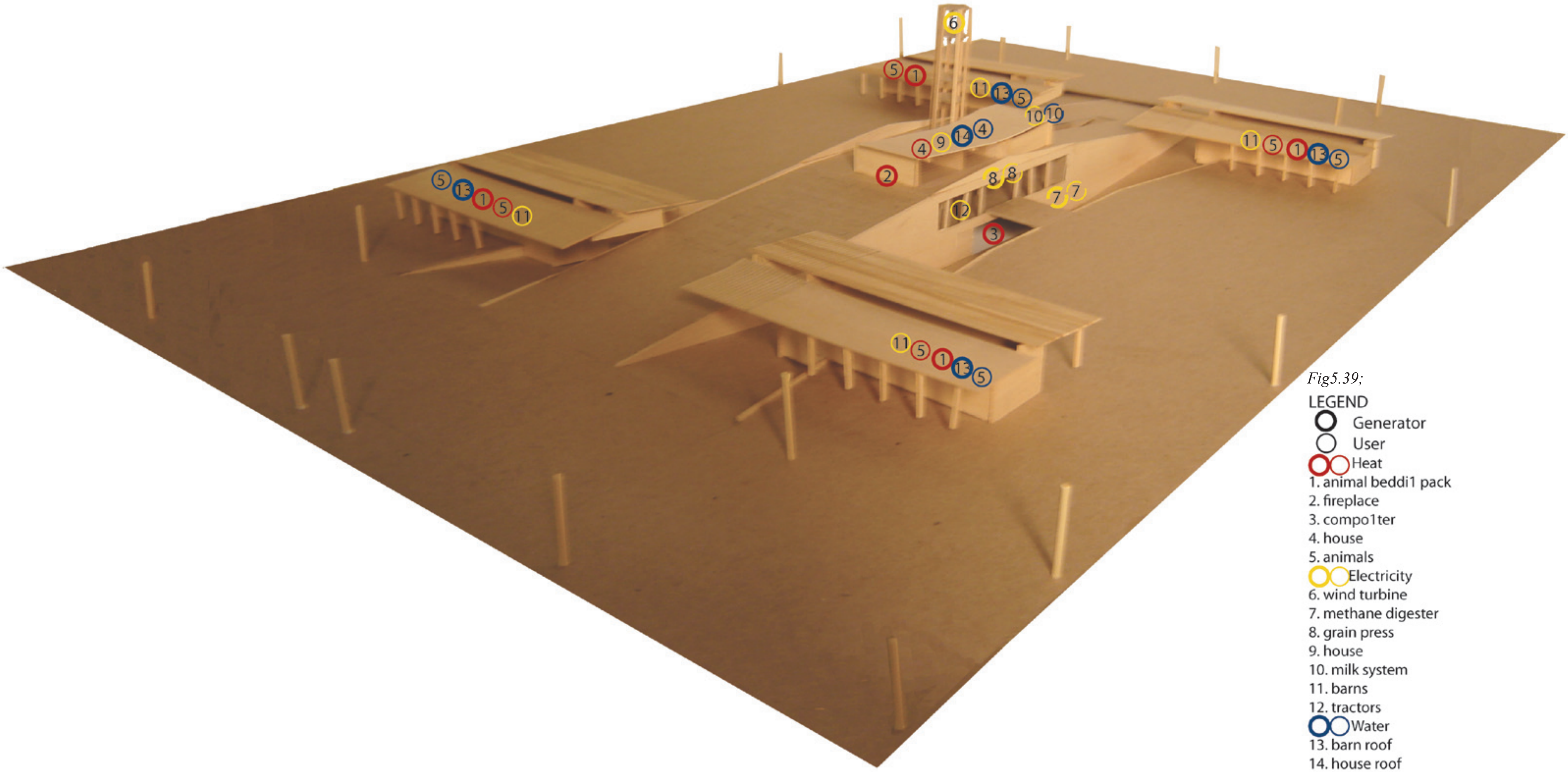


Fig5.39;

LEGEND

Generator

User

Heat

1. animal beddi1 pack
2. fireplace
3. compo1ter
4. house
5. animals

Electricity

6. wind turbine
7. methane digester
8. grain press
9. house
10. milk system
11. barns
12. tractors

Water

13. barn roof
14. house roof

> The most satisfactory thing about such a vision and such a goal are that one must work perpetually with nature and that the task is never really finishes, nor the vision ever really achieved. […] It is not a task or a vision with which one can grow bored, for one is living with the whole of the universe which, as all will agree, is fairly inexhaustible during the short span of our lives (Bromfield 1965, 80).

The systems on the Woven Lea Farm are always changing. This is the basic infrastructure of the farm, however, the farmer will continue to change and make the systems more balanced.

The systems described above, taken from many practices and approaches, make up a complete and efficient farm. The design is proven to be successful in terms of energy and economics. This design is a hybrid approach. One approach would not have been successful, as it is optimal to take the best from within all approaches studied in order to make an even better model for farming. These systems combined with the architecture of the farm create a model of farming which has sustainability as a goal alongside food production. This model represents the sustainable approach to farming.

CONCLUSION

APPLICATION OF AGRITECTURE

VI

The design of the Woven Lea Farm represents an integration of farm culture, farm technology, and sustainability issues. This design thesis attempts to be a practical and reasonable solution to the issues of sustainable farming.

Agriculture architecture has a long legacy, starting with the villa rustica in Roman times, to the traditional bank barns built by the immigrants to North America, to the contemporary industrial barns. Villa architecture and farm architecture diverged early on within history. The villa urbana is a place of retreat from the city and offers an experience of nature. This is a common phenomenon within today's society. The villa rustica, on the other hand, represents a productive relationship between man, architecture, and land. The Woven Lea Farm brings these two ideas together. The farm family enjoys the peacefulness of the country, but also the labour of working the land. The design thesis is not only a production unit, but a way of life.

The farm is an important icon within our society. It represents a cooperative and moral relationship with the land. Unfortunately, it is often idealized and represented falsely within our society. The historical forms appeal to society more than their contemporary counterparts. This is likely due to the lack of place for modern industrial architecture within the farming context. Contemporary farm architecture is often designed around the machine. The Woven Lea Farm uses the site, land, and nature to design the agricultural operations and architecture. It does this in order to convey a form which represents the important ideals society and the farmer value on a farm.

Many architects have also left their imprint on agricultural architecture. Jefferson, Downing, and farmers have left important ideas about farm design. Jefferson understood that agricultural architecture must uphold the high morals of farming. He was also an advocate for the use of all best practices gathered from various precedents within design. Where Jefferson suggests using many practices for a better result, Downing suggests choosing particular styles to create overall effect. Downing found the beauty of the farm in its usefulness; thus, the useful and practical elements become the beautiful elements in the Woven Lea Farm. Finally, farmers cannot be overlooked as designers of the rural landscape. Perhaps unconsciously, they are architects of their farms. Their straightforward approach to farm design is just what the rhetoric and aesthetic of farm architecture needs. If it is not practical don't design it. These architect's ideas were important precedents to the design of the Woven Lea Farm.

SO WHY DO YOU NEED AN ARCHITECT TO DESIGN A FARM?

> *Woody Ransons graduated from Harvard architecture in 1972. Woody met his wife in Virginia and started a farm with a prefab Sears barn. Woody morphed it with his architectural flair and created a successful dairy farm, making, cream, milk, and ice cream. As he cleared the bush on the farm he strategically left trees in the field for shade for the animals. He cleverly used the sloped site to process the raw milk into ice cream or milk bottles for sale, all powered by gravity. But "it doesn't take an architecture degree from Harvard to design these common sense methods" [a Waterloo architecture graduate can do it too!] (Fields of Plenty, 2005).*

An architect is trained to find creative and often simple solutions to common problems. This design thesis presents a farm which solves the problem of sustainability in a simple manner. This is not done with complicated technology, computers, or machines, but with simple things like gravity, sun, and wind. The architecture makes solutions for common problems of farming. Architects are currently being trained to use passive systems in design and to be more energy efficient. Why not apply these tools to farming as well? Like Palladio, who had the appropriate skills during the Renaissance, architects have skills which are useful for solving the issues farmers will face in the near future.

Most importantly, architects are coordinators. They can manage many disciplines and combine them into complex systems. They can coordinate structure, engineering, lighting, ventilation, electricity, and manage costs. Architects also integrate culture, beauty, and farmers' personalities into the design. All of these elements are essential to this Woven Lea Farm.

IS THIS DESIGN A SUCCESS?

The success of the thesis design can be evaluated by examining the following issues, which were identified in the research.

The first and most important issue is the one of scale. The farm is only 60.7 hectares (150 acres), but these 60.7 hectares (150 acres) are intensely and efficiently worked in order to provide the farmer with a reasonable income.

The agriculture industry has changed drastically over the past 200 years. The major change is the scale. When farming started using fossil fuels as a power source, everything about the agriculture industry grew in scale: the amount of energy used, the size of rural communities, the size of land holdings, the size of building architecture, the size of machinery, and the quantity of machinery. This growth, if not stopped, may cause the extinction of rural culture. The Woven Lea Farm tries to design at a scale which is economically, culturally, and environmentally sustainable.

Woven Lea Farm addresses the need to reduce energy. The design does not need to import any external energy. It maximizes the potential energy stored in the operations of the farm like heat from compost, and insulation from hay storage. After the energy on the farm is maximized using existing potential, technologies are implemented to generate additional electricity. Energy is generated with a grain press for bio diesel, and a wind turbine and methane digester to generate electricity.

The environmental concerns surrounding the agriculture industry are of great concern. Issues of water contamination, soil erosion, soil infertility, and run-off are common problems for farm operations. Many regulations are being put in place to assist farmers in controlling these problems. The Woven Lea Farm tries to work with the ecosystems around it and to add to them. Native grasses and trees are used over the site and heirloom varieties are planted in the orchard. The operation tries to mimic nature to encourage the system to balance itself. However, the design requires more extensive research into landscape management and ecology before it can become a complete ecosystem design. The strategies used are simple, but they are a good start.

Architecture is another issue the design thesis needs to address. Society longs for the historical architecture even though it cannot operate in the contemporary farm climate. The old barns represent a relationship to land, which is redesigned in the Woven Lea Farm. The new form does not look like a traditional farm, but it is related to good farming practices. The architecture also relates to the innovation present on this farm and the creative systems that make up farm operations. When someone sees the Woven Lea Farm from the road, they can understand many of the processes which operate the farm through the visible architecture. They can see the wind turbine, the cistern, the solar orientation, the hay storage as insulation, and the diverse and complex animal and plant relationships. The architecture is not only the infrastructure of the operation, but also the display of it for other farmers to see, and perhaps borrow and adapt for their own operations.

The design was required to fit into contemporary farming culture. In order to be useful, a farmer must look at the design and accept that it might work and that he can implement it. The Woven Lea Farm uses many existing practices in its operations. It also uses practical solutions to problems that are reasonable and do not require excessive amounts of technology, knowledge, or labour.

Economics are an essential factor for farmers' decisions. If the design is not cost effective, why bother? The farm generates

$1465 per hectare per year ($3620 per acre per year). This equates to $542, 990 gross income per year. These numbers are significantly higher than is usual for conventional industrial farming methods. Two issues might be raised about the economics of the model. The initial investment of the design is likely higher then a traditional farm purchase, making an already expensive business to get into an even higher-priced one to start. This could discourage the younger generation from starting farming. The design also does not account for any phasing or evolution of the operation. A farmer often starts small and grows their operation as income allows or needs. This model does not account for this natural evolution. Studies about how, when, and why farmers grow would need to be done in order to replicate this process.

In the current system, most new farmers are the sons and daughters of the previous generation. A farmstead must be able to adapt to a second family living on the farm: it must or grow or evolve. There are many ways farmers pass the farm on to the next generation. This design thesis has not addressed this issue. The growth and evolution of a farm is a complex system on its own, and requires research not done in this thesis. The Woven Lea Farm does, however, try to instill an ethical sense of value, and a strong relationship to the land, which Salatin argues is a good start for encouraging the children to take on the family farm.

There is an abundant supply of technologies, tools and approaches a farmer can choose from for their operation. The approaches range from no-tech artisanal farming, to high-tech industrial farming, to information age systems farming. The thesis research explores the technologies that are associated with each approach and evaluates them based on energy, environment, economics, ease, and culture. The Woven Lea Farm adopts or redesigns the methods which suit the goals of the design best. The architecture is used to connect and combine these methods into a complex system of relationships.

The ideas presented in the Woven Lea Farm are not necessarily new ideas, nor are they the most up-to-date. In many cases, the research discovered someone who already implemented the technique. The combination of these techniques into one complete system, is however, unique.

WHY DON'T FARMERS USE THESE STRATEGIES ALREADY?

I grew up on a farm that my father loved. He always told me he was going out to play, never to work. Because of his enthusiasm, he continues to strive towards creative farming. He was the first farmer in his neighborhood to begin no-till farming, prompting all the neighbors to think he was crazy. My father is an innovative farmer and my parents' farm is a unique farm.

I have found through this research that this is not the normal case. Farmers will use technologies they feel comfortable with no matter what the economic or environmental reasons to support or disprove it. Contemporary farmers are required to be business people, accountants, managers, scientists, biologists, ecologists, mechanics, electricians, builders, etc., on top of being farmers. They are the contemporary Renaissance men. The knowledge base required for a farmer is immense and the sources are diverse and fragmented. Each journal has a bias, and many sources contradict each other based on how they present or manipulate their research. A farmer must feel comfortable with a technology and the plethora of information does not help him choose which strategy is best for the farm operation. The research required to design the Woven Lea Farm is immense; it is my hope that this document will provide farmers with a starting point for further research and implementation.

Many of the technologies implemented in the farm design require long-term thinking. The farmer must think beyond this year's crop yield to the future, beyond his own lifetime. Industrial thinking is all about short-term profits: for example, this year's high corn prices have caused many farmers to plant corn on the same field as last year, threatening the future health of that soil.

Long-term thinking requires an ability to predict the future to a certain degree. Information and evaluation are some of the current methods of predicting the future. This information must be gathered by monitoring a farm operation. A farmer can monitor and adjust his ecosystem with the information gathered in order to continue profitably. The Woven Lea Farm is a complex system where along with the chores to be done, a large amount of time must be devoted to information gathering and to monitoring the system. These tools are beginning to become available to farmers with GPS, robotic milking, computerized identification systems, publications, computers, and the internet as long as they are used appropriately. Each farm is unique and a computer cannot adjust to this uniqueness on its own. This thinking is opposite to the standardization of industrial farming. "This sort of low-tech pastoralism […] [is] all information-age stuff we're doing here. Polyface Farms is a post-industrial enterprise. You'll see" (Pollan 2006, 191). Thus the Woven Lea Farm is also a post-industrial endeavour.

The Woven Lea Farm does not claim to be the best nor the only way to farm sustainably. There are many solutions to the problem of maintaining sustainable farming, and this is only one option. Every farmer is different and the solutions are as numerous as there are farmers. The design thesis generates possibilities and potential for the farm of the future. It is a critique of the current practices as well as an exploration of how these processes might produce better results with only slight alteration.

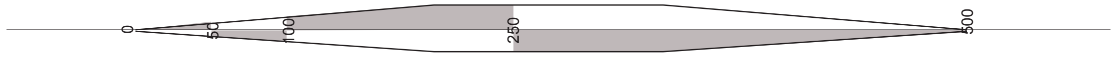
A neighbor of mine who has been farming all his life told me once that there are no two barns alike. And it's true. For every type I have listed there are still no two English, Bank, or Dutch barns exactly alike as every farmer has built his or her barns into a landscape and each has a farming operation different from the neighbor's down the road (Jon Radjokivik, 155).

DESIGN DRAWINGS VII


N

Fig7.1;

PROPERTY PLAN

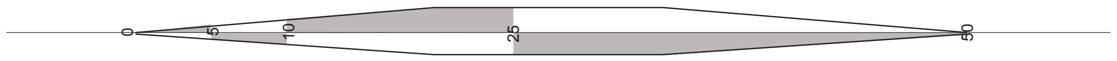


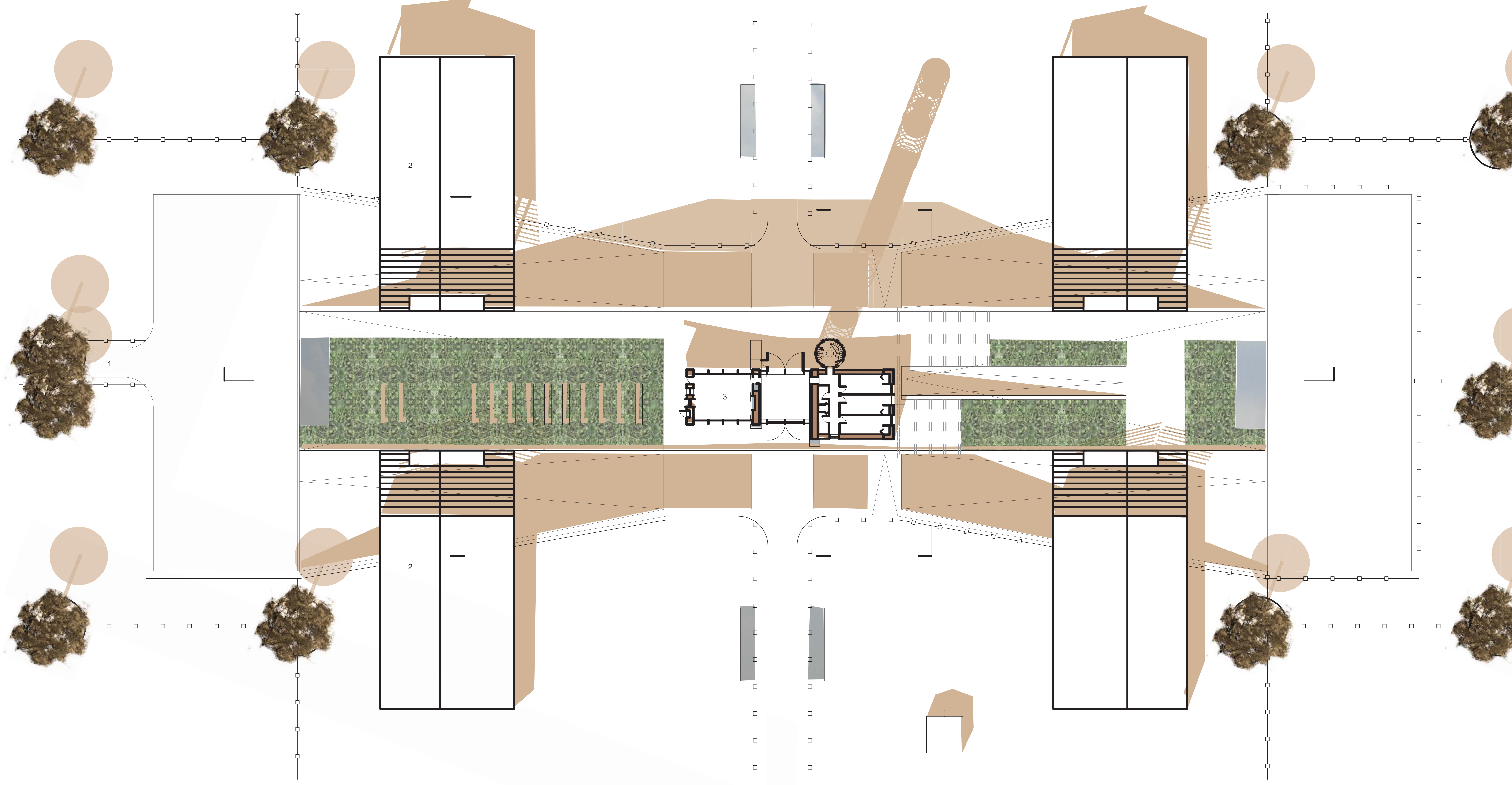
SOUTH ELEVATION

WEST ELEVATION

Fig7.2;

PROPERTY SECTIONS

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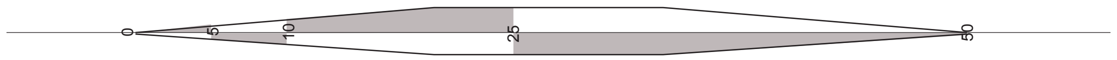
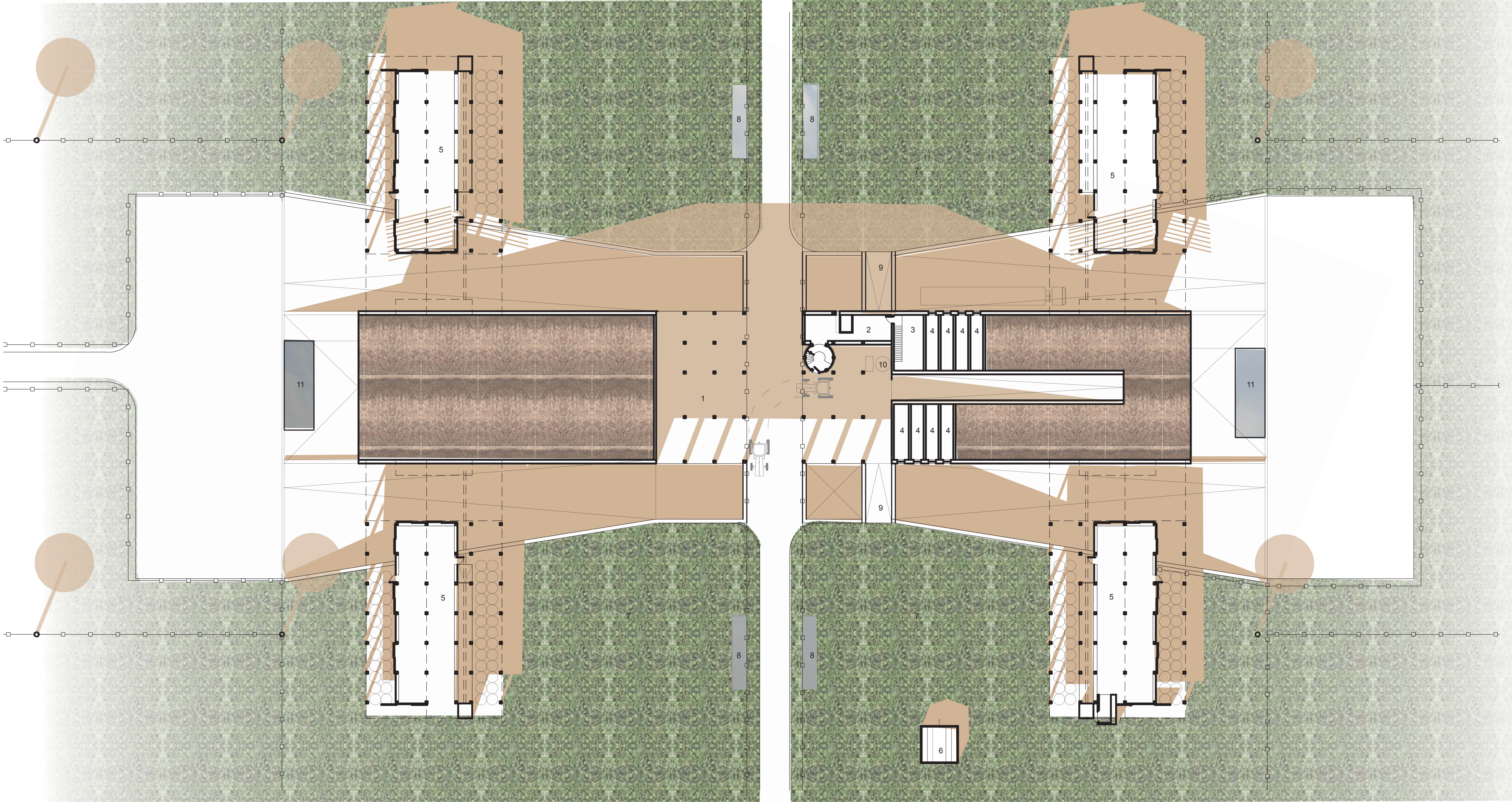
1	main laneway
2	barn
3	house

Fig7.3;

+5 Farmyard Plan





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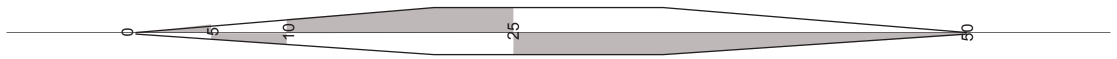
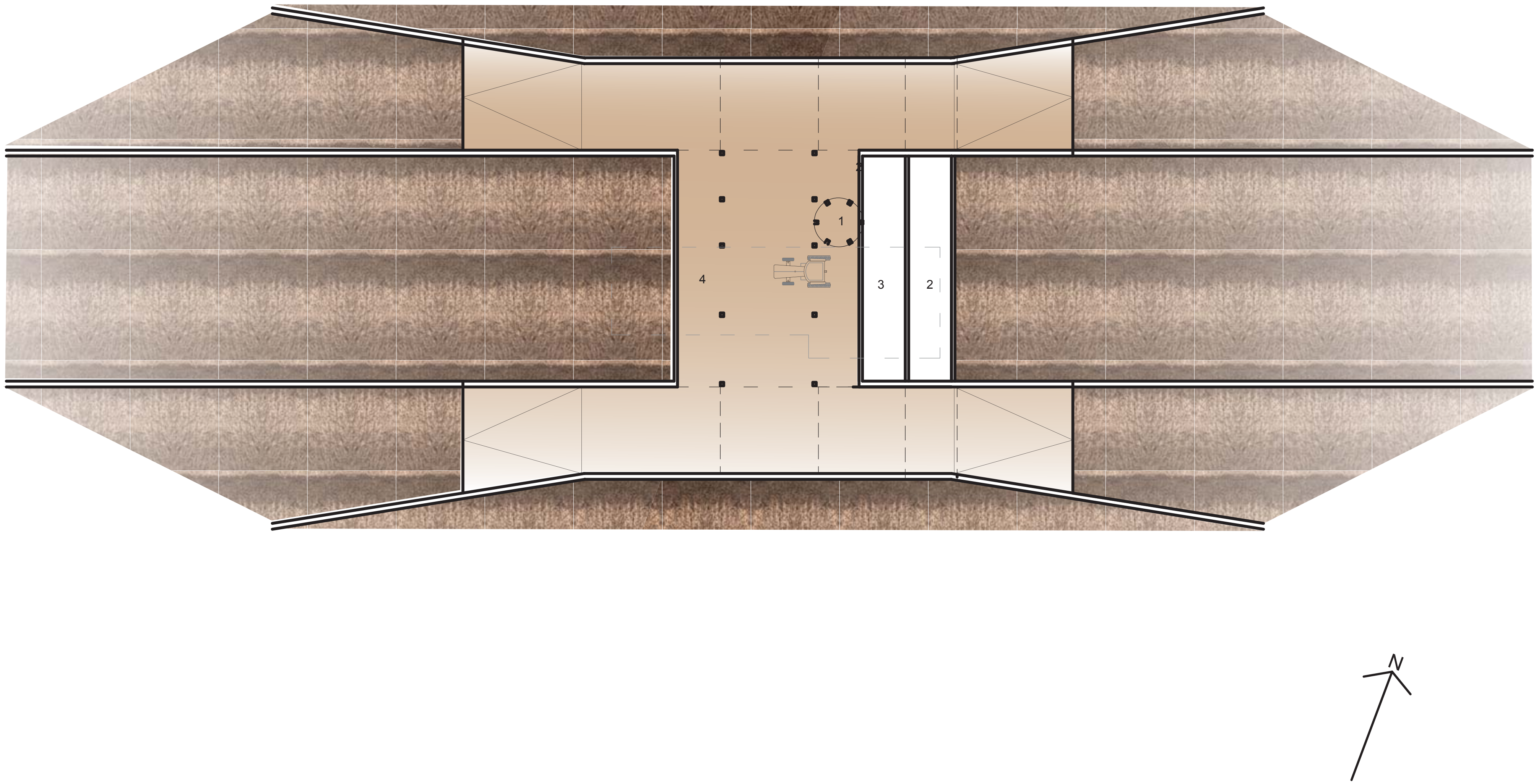
1	tractor storage
2	house basement
3	milk house
4	grain bin
5	barn
6	chicken coop
7	pasture
8	water trough
9	manure digester chute
10	grain press and biodiesel storage
11	regenerative water pond

Fig7.4;

+-0 Farmyard Plan

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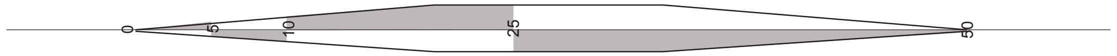
1	‘silo’ sump pump
2	manure digester
3	liquid manure storage
4	solid compost storage

Fig7.5;

-5 Farmyard Plan



N-S SECTION THROUGH GRAIN BINS LOOKING WEST

N-S SECTION THROUGH BARNS LOOKING EAST

Fig7.6;

FARM YARD SECTIONS

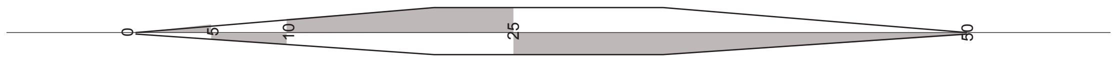
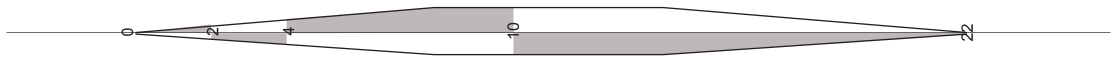


Fig7.7;

East-West Farmyard Section



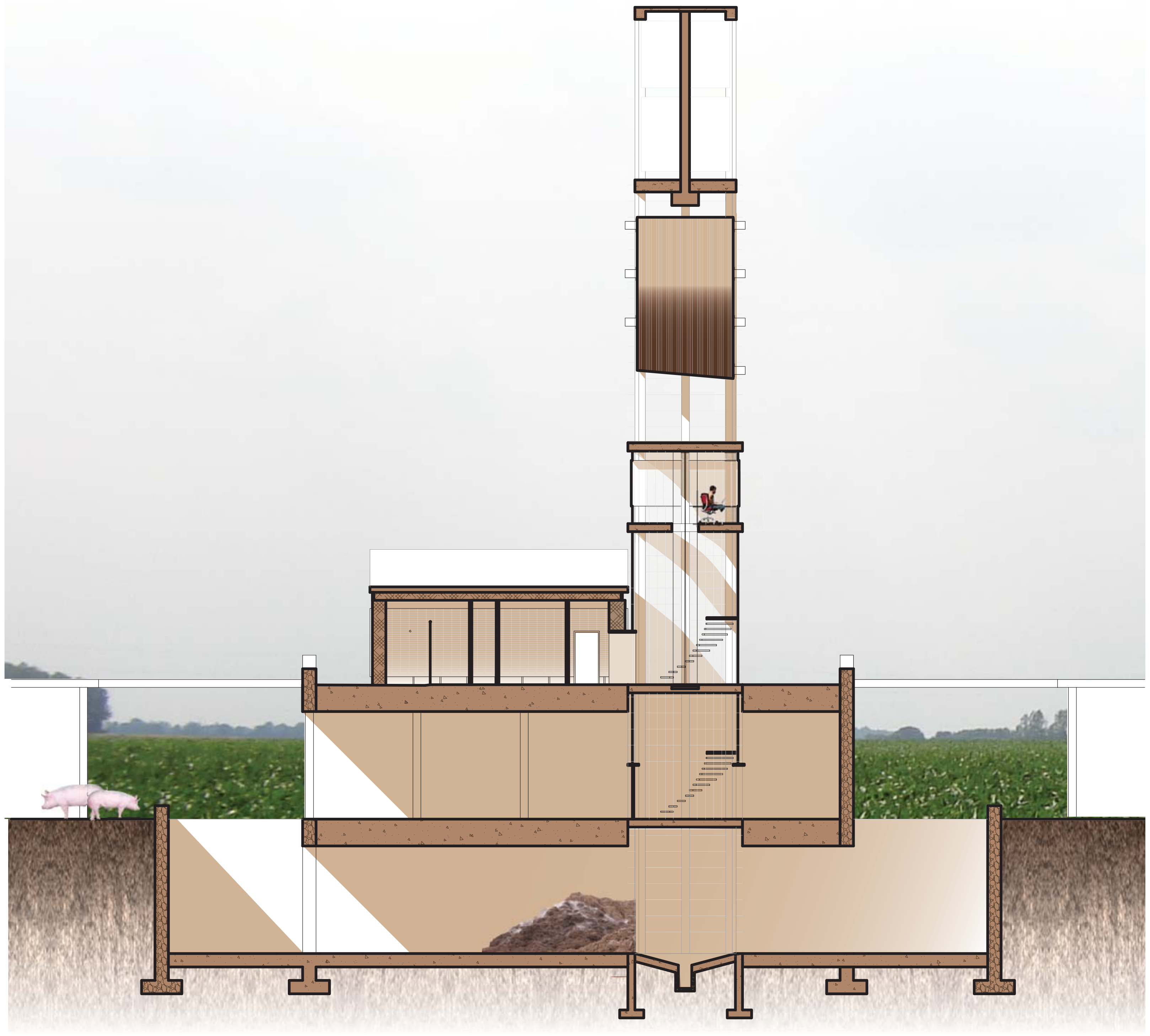
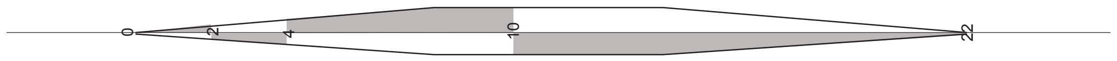
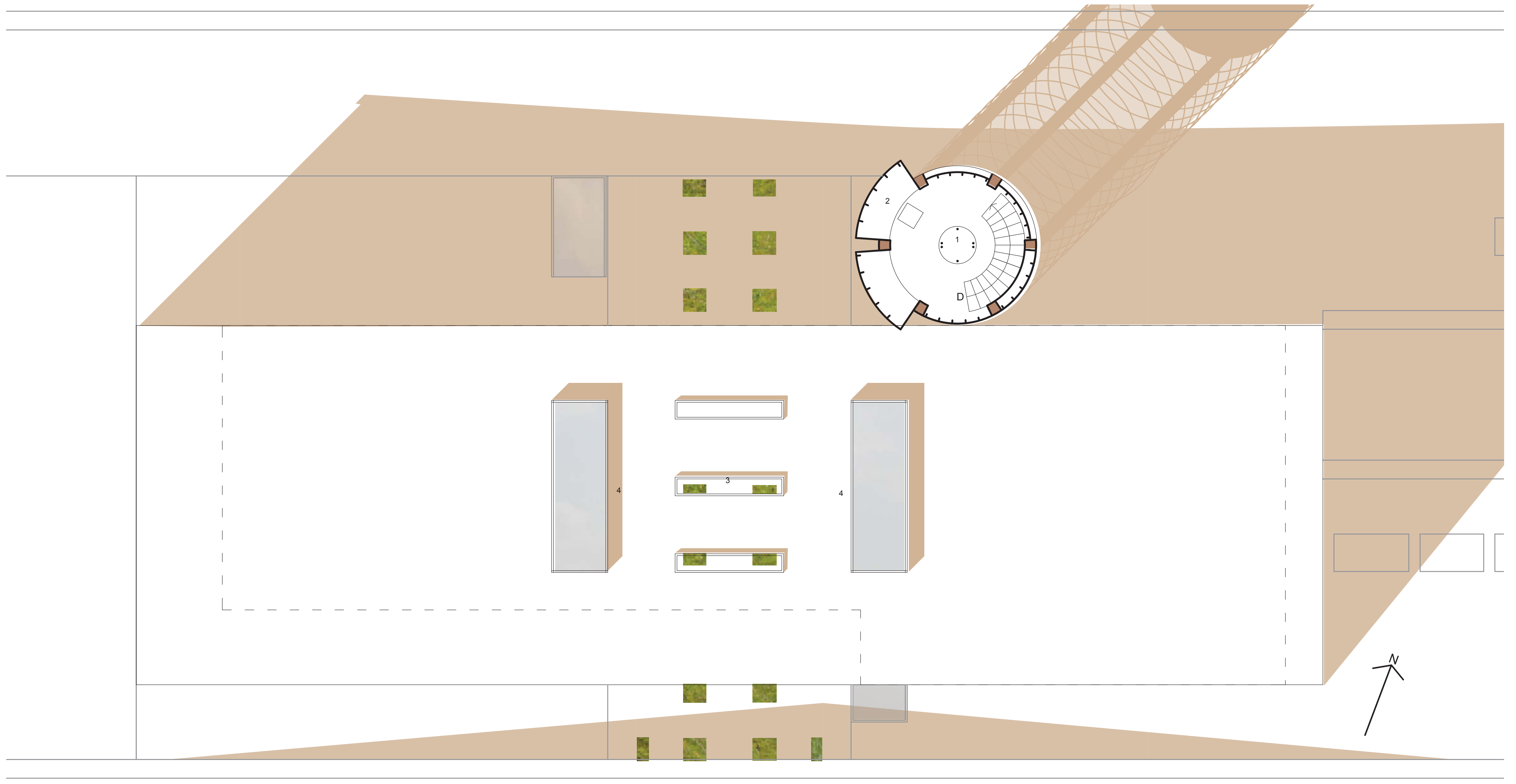


Fig7.8;

NORTH-SOUTH FARMYARD SECTION





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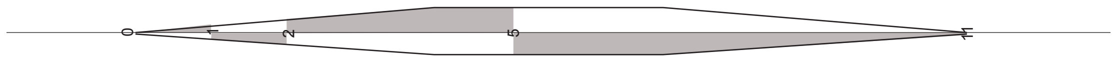
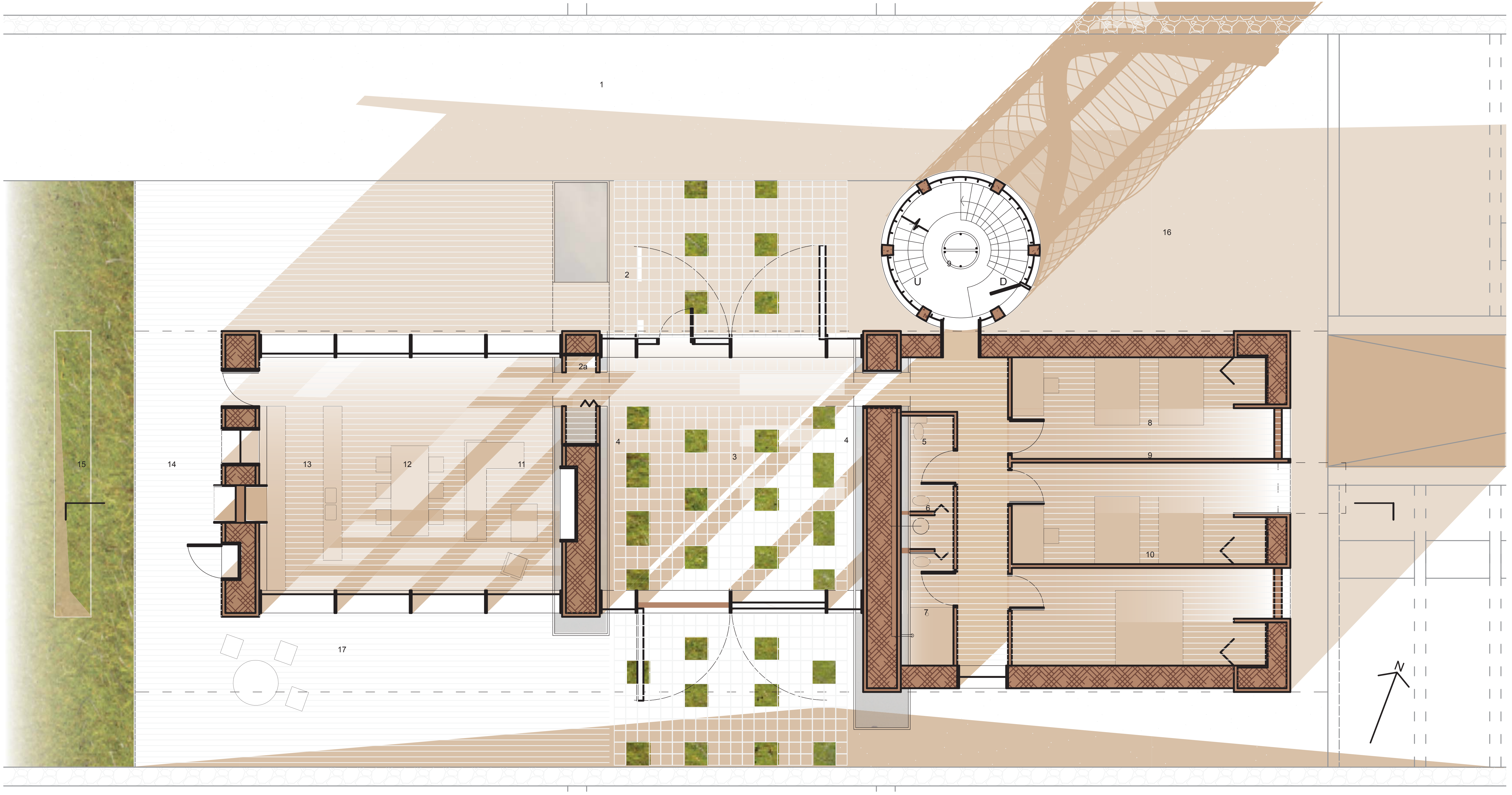
1	weighted elevator
2	office desk
3	skylight
4	water collection skylight

Fig7.9;

+11 House Plan





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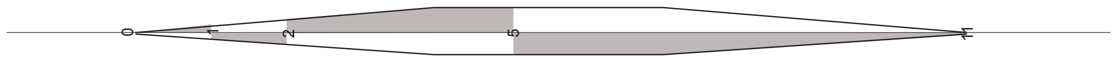
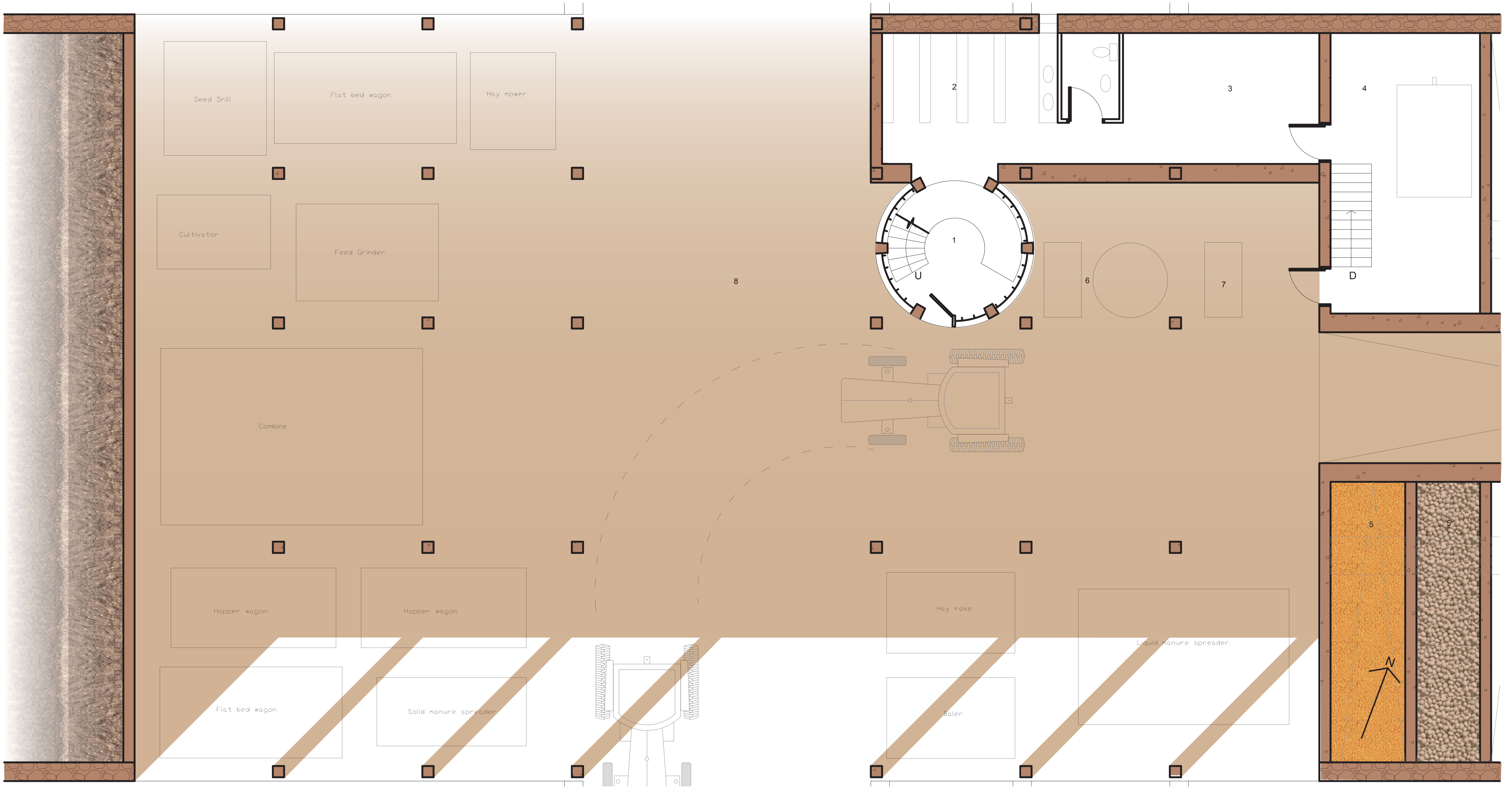
1	laneway
2	main entrance door
2a	entrance vestibule
3	indoor patio and winter garden
4	water collection pools
5	water closet
6	hot water heater and closet
7	shower room
8	children's bedroom
9	children's bedroom
10	master bedroom
11	family room
12	dining room
13	kitchen
14	summer kitchen
15	vegetable garden
16	car park
17	patio

Fig7.10;

+5 Ground Floor House Plan





Seed Drill
Flat bed wagon
Hay mower
Cultivator
Feed Grinder
Combine
Hopper wagon
Hopper wagon
Flat bed wagon
Solid manure spreader
Hay rake
Liquid manure spreader
Baler
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1	silo stair well
2	pantry
3	wood storage
4	milk house
5	grain bin
6	grain press and gas tank
7	generator
8	tractor shed

Fig7.11;

+-0 Basement House Plan

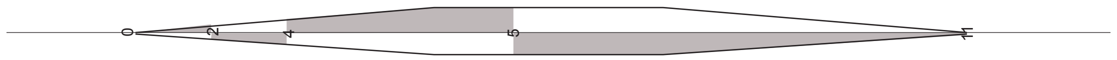
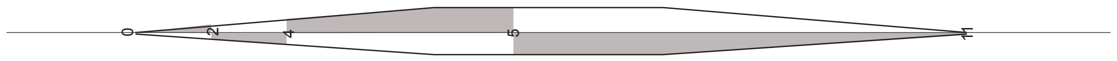


Fig7.12;

South House Elevation



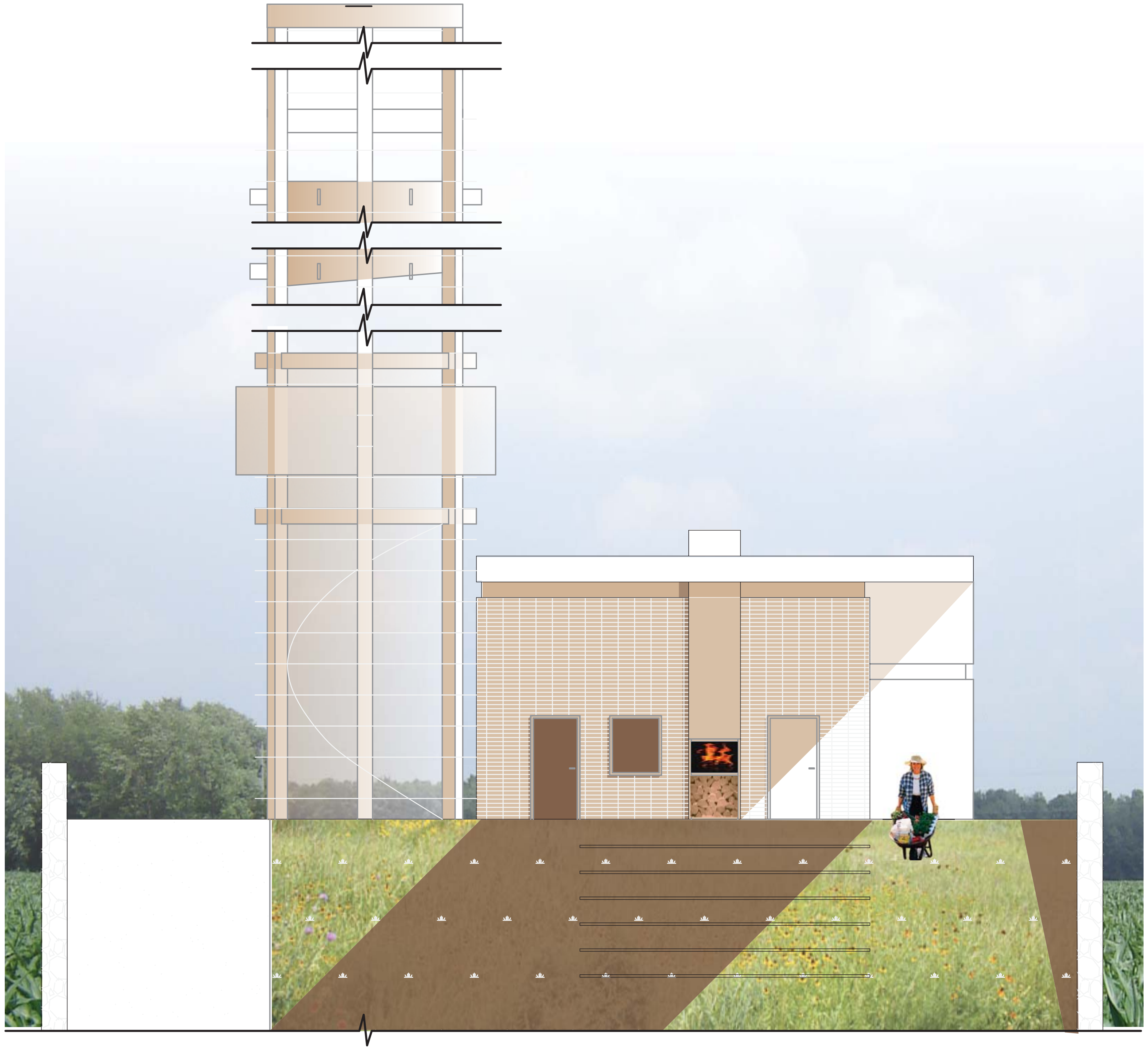
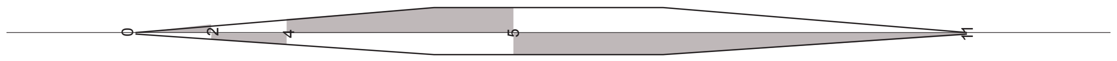


Fig7.13;

WEST HOUSE ELEVATION



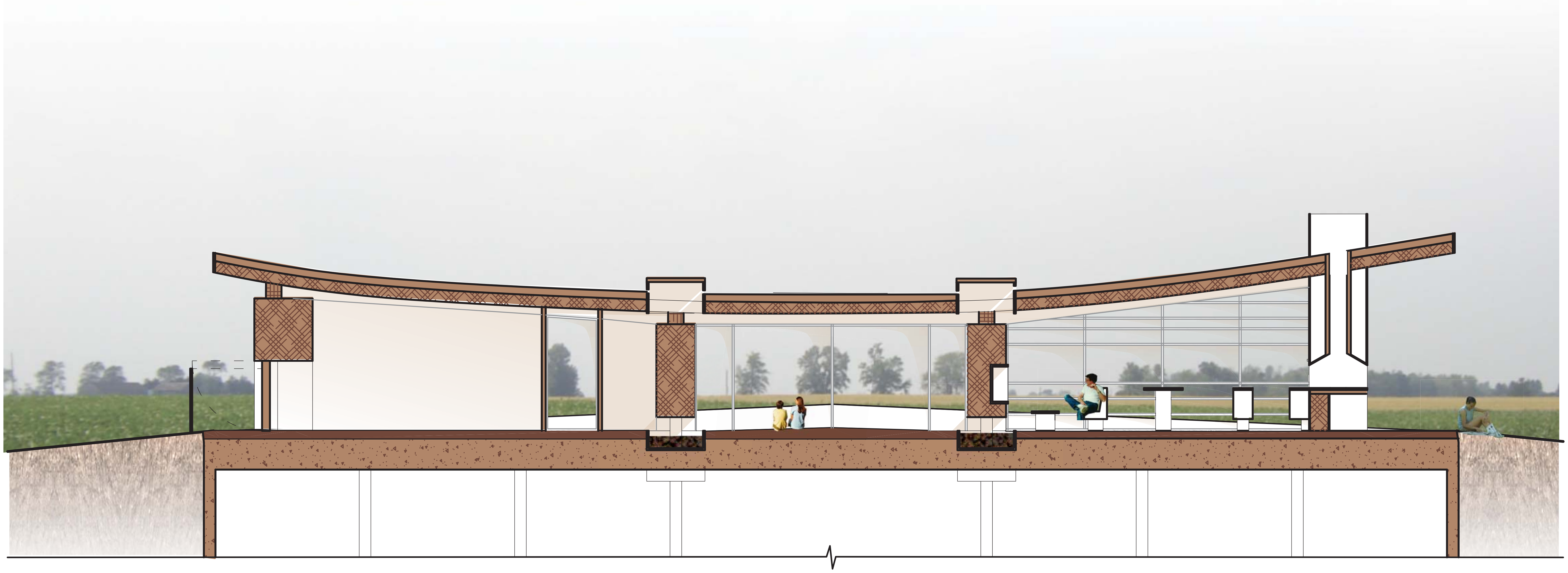
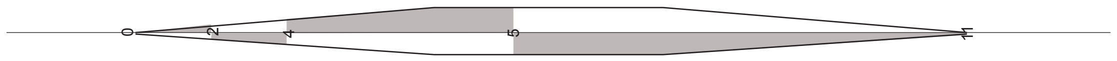
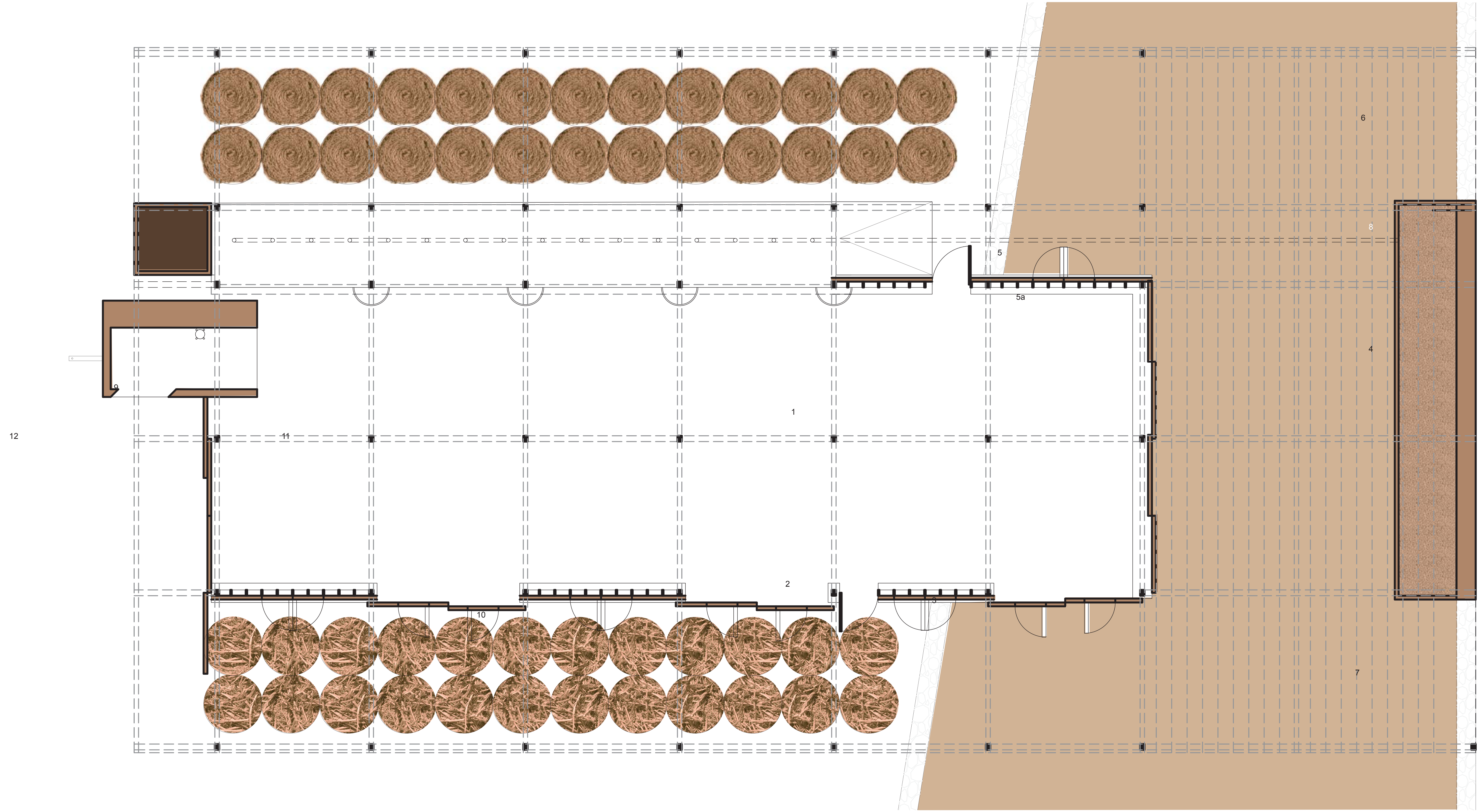


Fig7.14;

EAST-WEST HOUSE SECTION

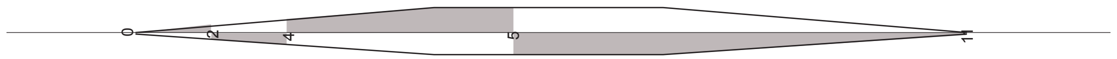



6
8
5
5a
4
1
12
11
9
2
3
10
7

1	main straw bedding pack for animals
2	sliding door
3	window
4	milking robot trailer
5	feed manger
5a	water mangers
6	hay storage
7	straw storage
8	water cistern
9	grain bin
10	loading doors
11	down-ramp
12	up-ramp

Fig7.15;

Barn Plan



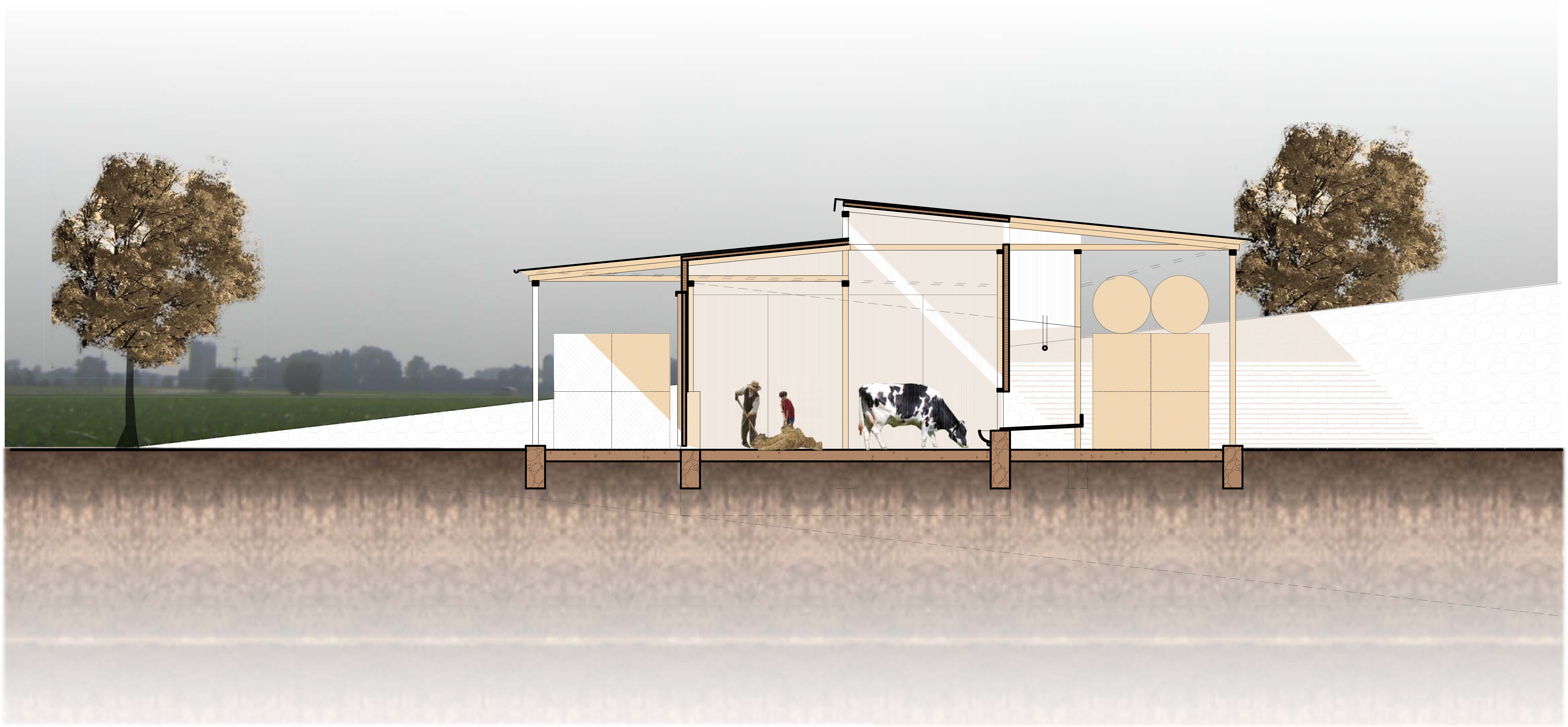
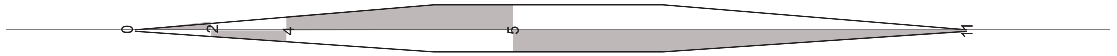


Fig7.16;

BARN SECTION



APPENDICIES

A1 - Ecosystem Analysis
The complete ecosystem analysis done regarding energy, aboitic, boitic, and cultural systems which affect Middlesex County and farming.

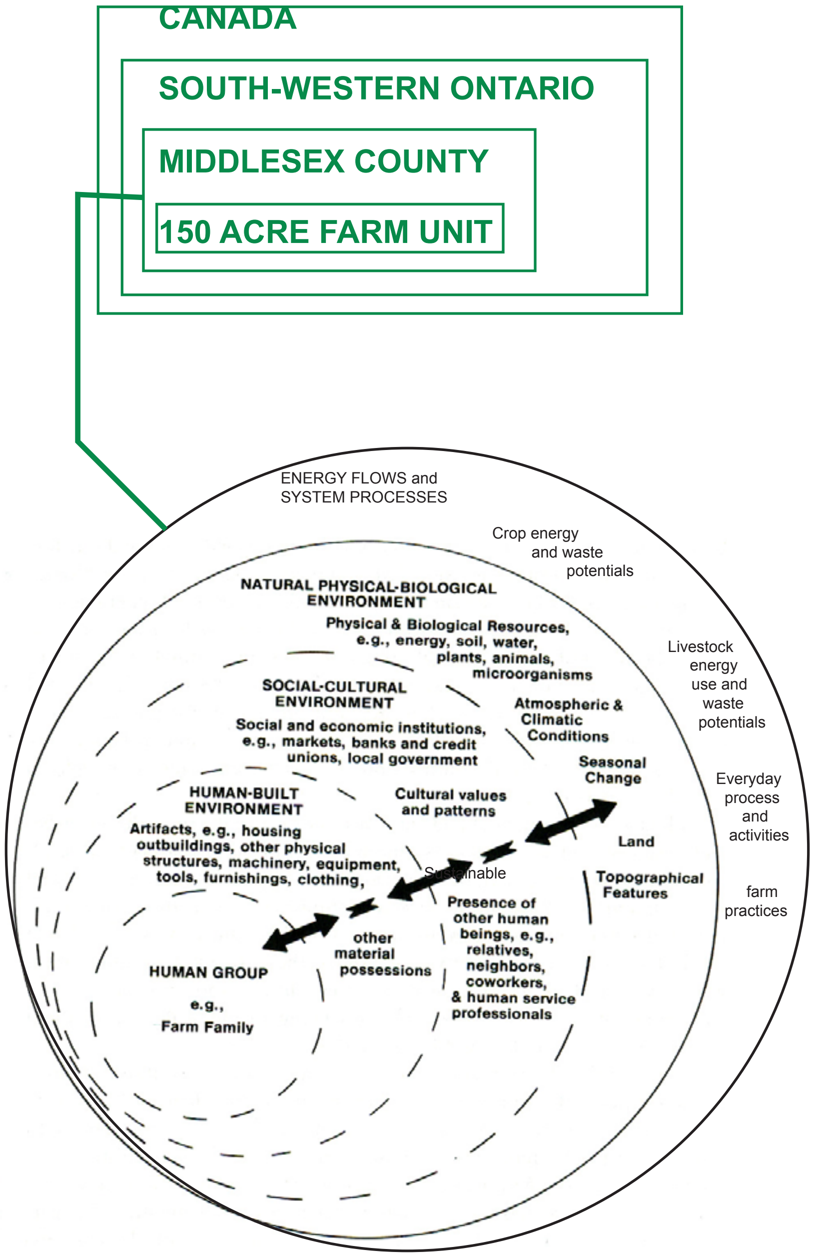
A2 - Viewshed study
An attempt to define a culture by the architectural and land forms of an area. Four concession blocks were studied to define the vernacular architecture and discover what the community is about.

Ecosystem Analysis

This report is about creating a new identity for the 21st century farm. This new identity is for an agriculture which exists in an information, global, and environmentally aware age. The pride and lifestyle of being a farmer has been lost in the excitement of the urban life and infinite possibilities of the society. “We have neglected the truth that a good farmer is a craftsman of the highest order, a kind of artist. It is the good work of good farmers – nothing else, that assures a sufficiency of food over the long term” (Berry 1981, 124). Farming should be an exciting option among many choices of lifestyles.

In 1976 the majority of Canada had a declining farm population (Ontario Institute of Pedology 1992). This was not a new discovery. In 1931 32% of Canada’s population was classified as rural farm. This dropped to 11% in 1961 (Tremblay and Andderson 1966, 12). The farm population continues to decrease into the 21st century. This report speculates on the factors that might keep the next generation on the farm. Farming is hard work but there is a particular lifestyle and culture associated with rural life. If rural emigration continues, this culture will be lost. The design of the Estate Farmstead attempts to portray this culture through the architecture. The design attempts to remedy the thinking that the city is a better life than the country. Neither is better, but they are different. The Estate Farmstead, as the title suggests is a proud farm, but a practical and warm place to live. The architecture also ties in important sustainable, functional, and economic strategies for an over all new identity for farming through architectural design.

The role of the architect in the creation of this identity is as a designer of an architectural system which understands the farming process in its entirety. This report explores the many levels which influence and make up the farming ecosystem. These



are necessary for an architect to design an effective identity for the farm. These levels include energy and process flows, natural and biological environments, social and cultural environments, human built environments, and the farm family itself. They are described in the holarchy diagram on the right. These levels are mapped to understand how they operate and influence the farm design. This analysis finds six major attractors or detractors in the farming ecosystem; biotic conditions, economics, social communities, information, architecture, and energy. Many of these attractors or detractors need to be reconsidered as to whether they are helping the current state of farming or not.. These six influences determine the goals of the new farm identity. The goals of the design are to design a sustainable identity, to design a proud estate farmstead, and to facilitate a cultural community.

The Estate Farmstead addresses the issues presented in the report. The design finds practical and beautiful solutions to the issues of energy use, living arrangements, harnessing abiotic conditions, information input, and architecture. Architecture can create a sustainable farm.

Fig8.1; Ecosystem Holarchy

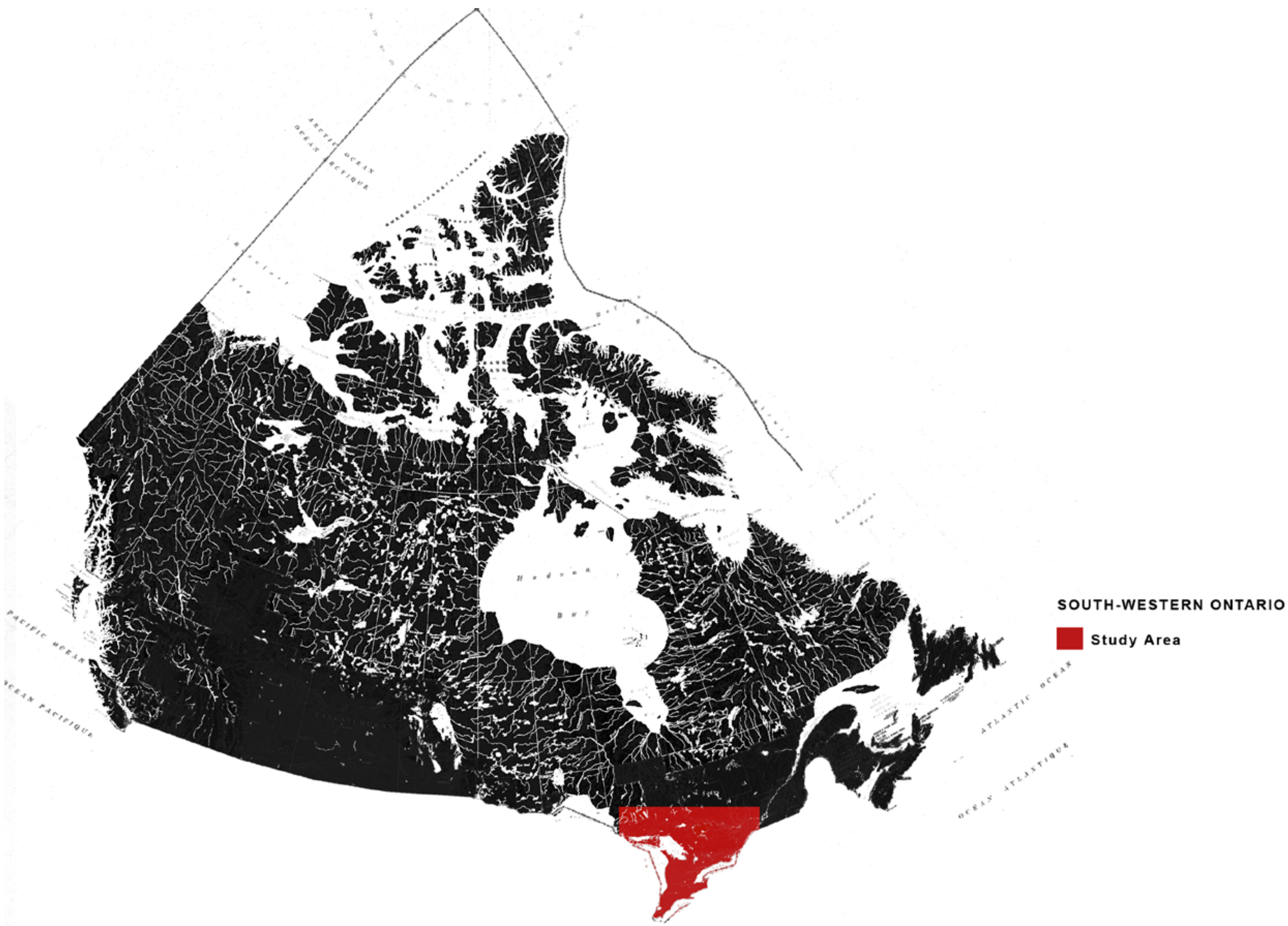


Fig8.2; Southwestern Ontario in relation to Canada.

CANADA

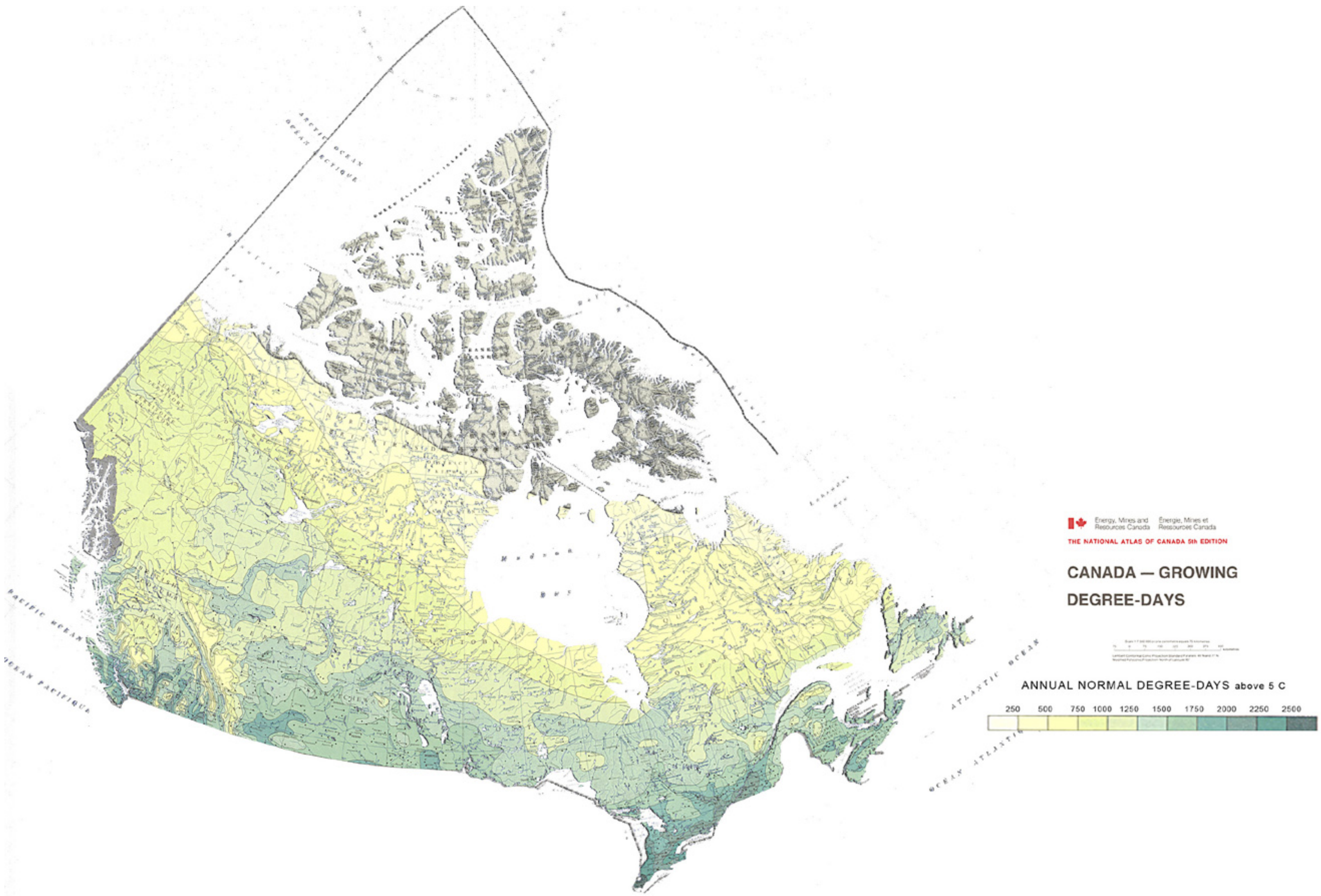


Fig8.3; growing degree days - used to estimate the growth and development of plants and insects during the growing season.

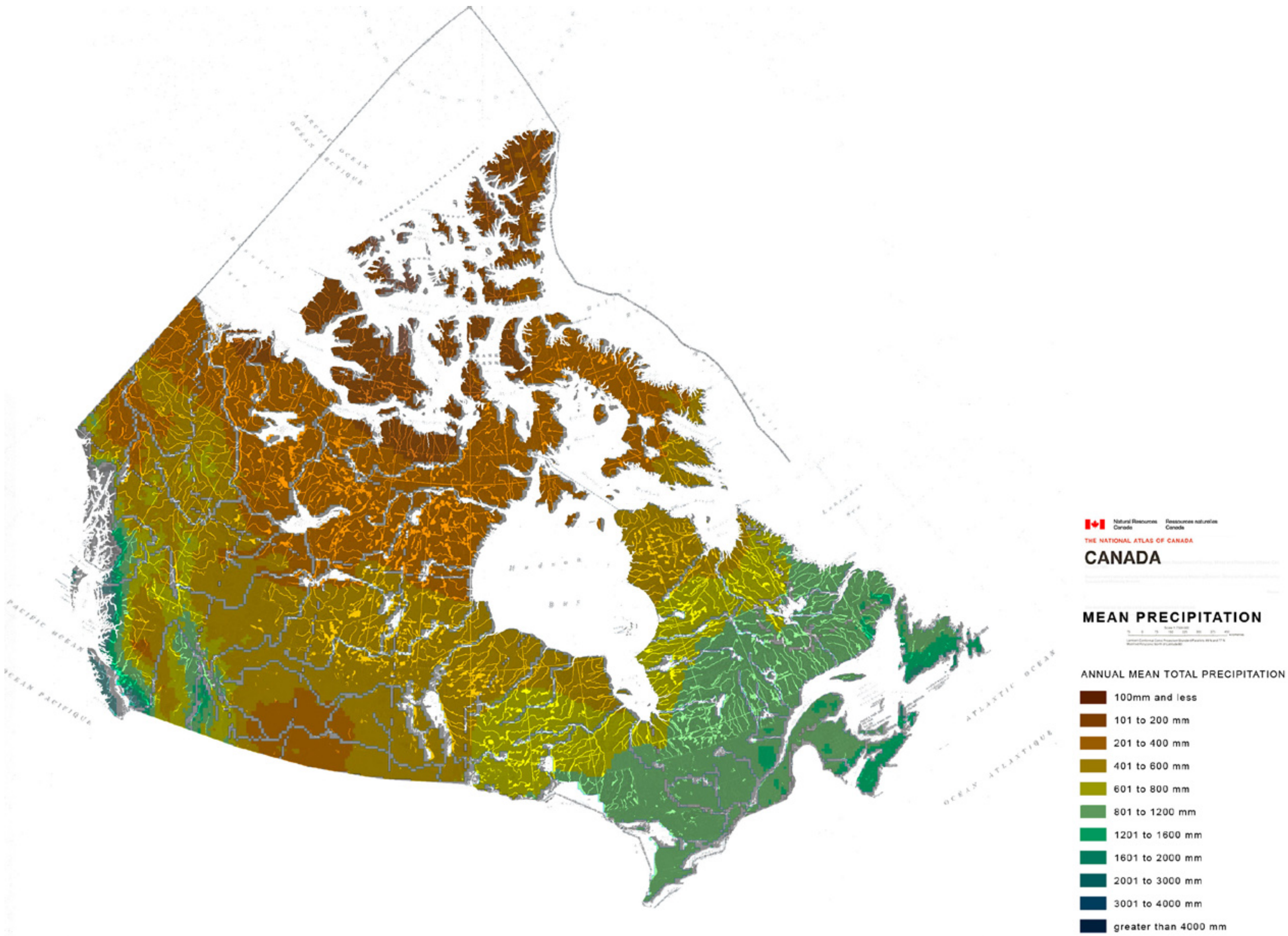


Fig8.4; mean precipitation for Canada.

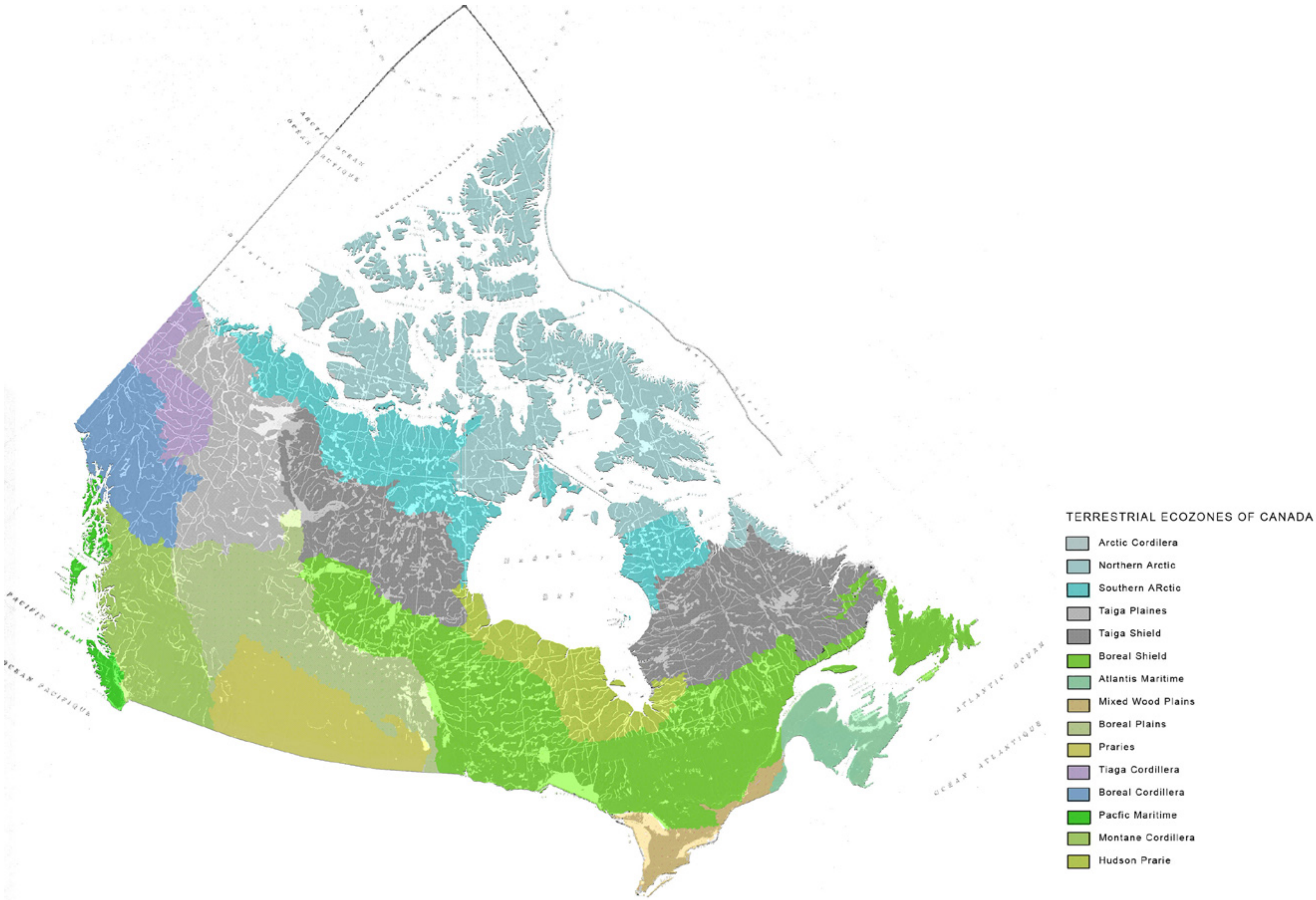


Fig8.5; the ecozones of Canada. Southwestern Ontario is located in the mixed wood plains

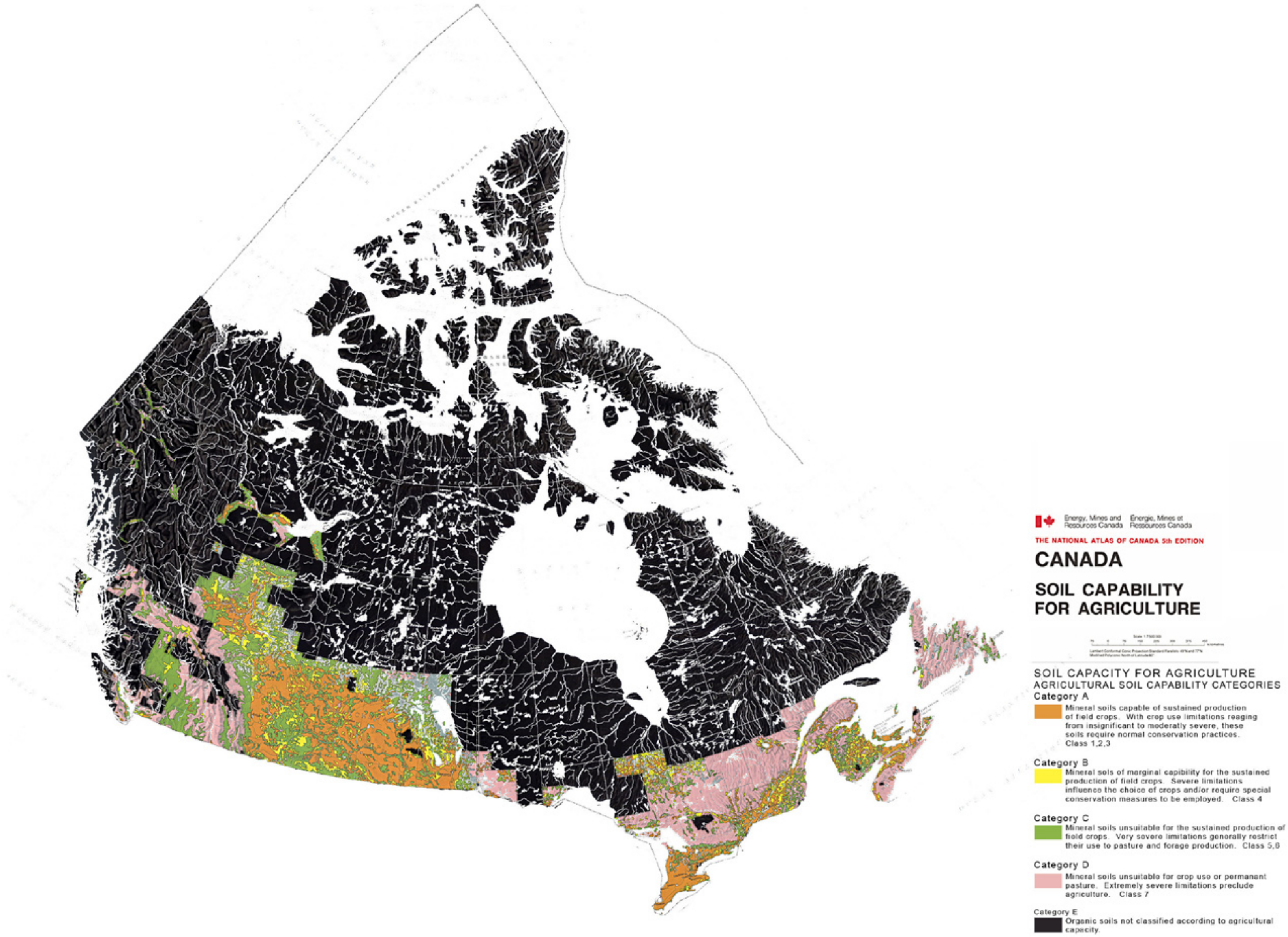


Fig8.6; soil capability for agriculture. Southwestern Ontario falls in catergory A which has little limitations to growth.

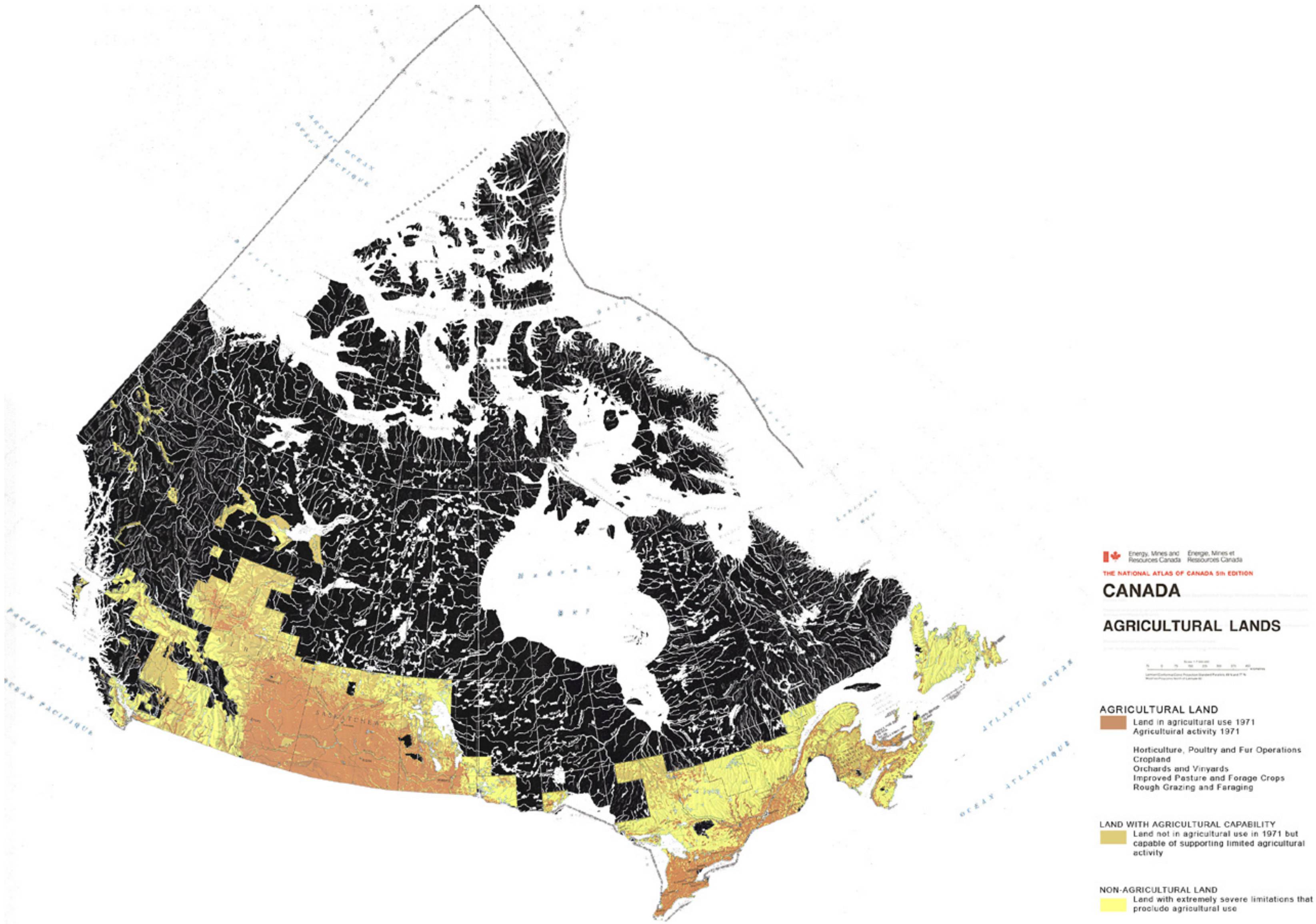
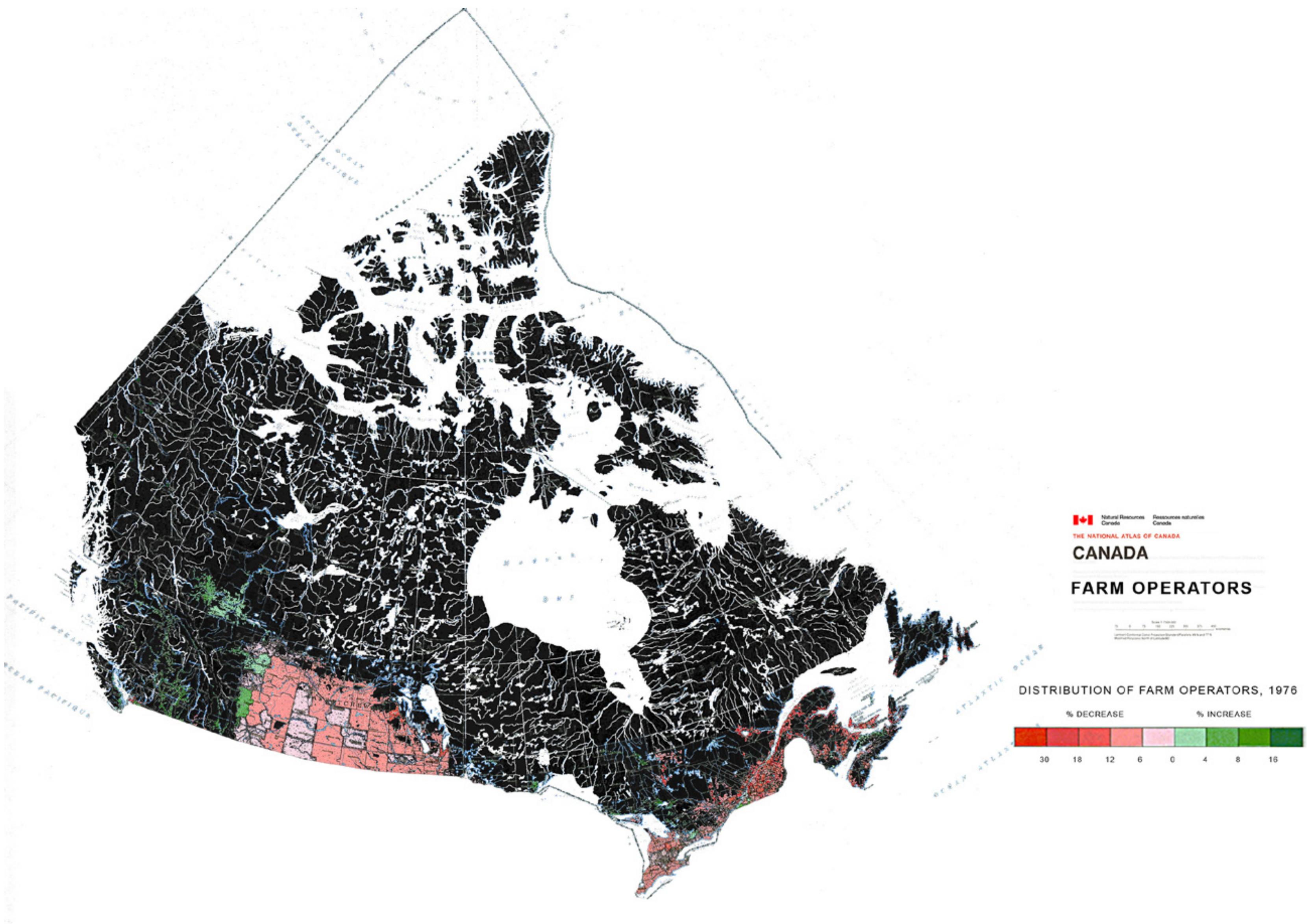


Fig8.7; Following the previous diagram are the agricultural lands in Canada and they follow a similar outline to the soil catergories in the previous diagram.



Natural Resources Canada
Ressources naturelles Canada
THE NATIONAL ATLAS OF CANADA
CANADA
FARM OPERATORS
DISTRIBUTION OF FARM OPERATORS, 1976
% DECREASE
% INCREASE
30
18
12
6
0
4
8
16

Fig8.8;

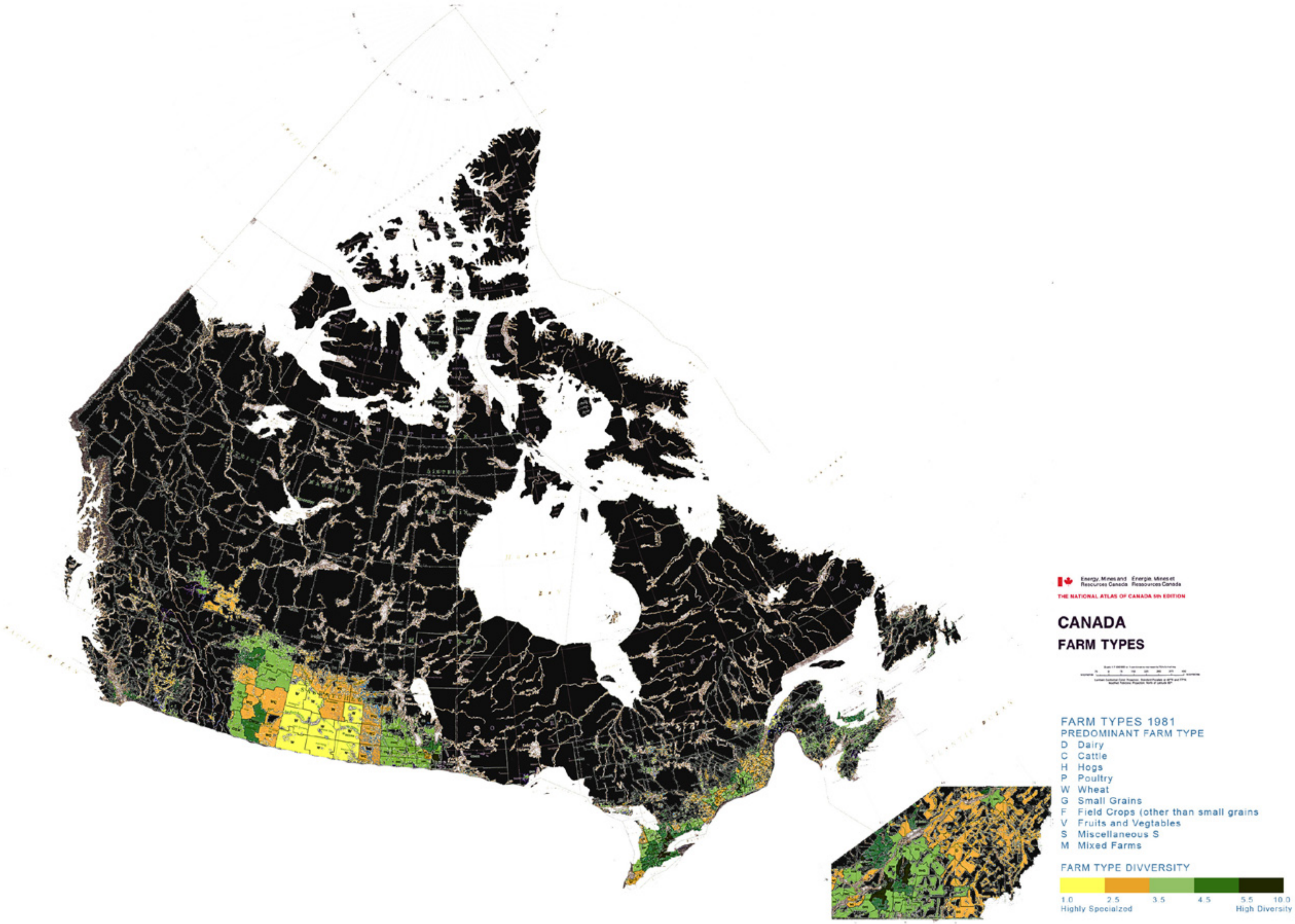

THE NATIONAL ATLAS OF CANADA 5th EDITION
CANADA
FARM TYPES
FARM TYPES 1981
PREDOMINANT FARM TYPE
D Dairy
C Cattle
H Hogs
P Poultry
W Wheat
G Small Grains
F Field Crops (other than small grains
V Fruits and Vegtables
S Miscellaneous S
M Mixed Farms
FARM TYPE DIVVERSITY
1.0 2.5 3.5 4.5 5.5 10.0
Highly Specialzed
High Diversity

Fig8.9;

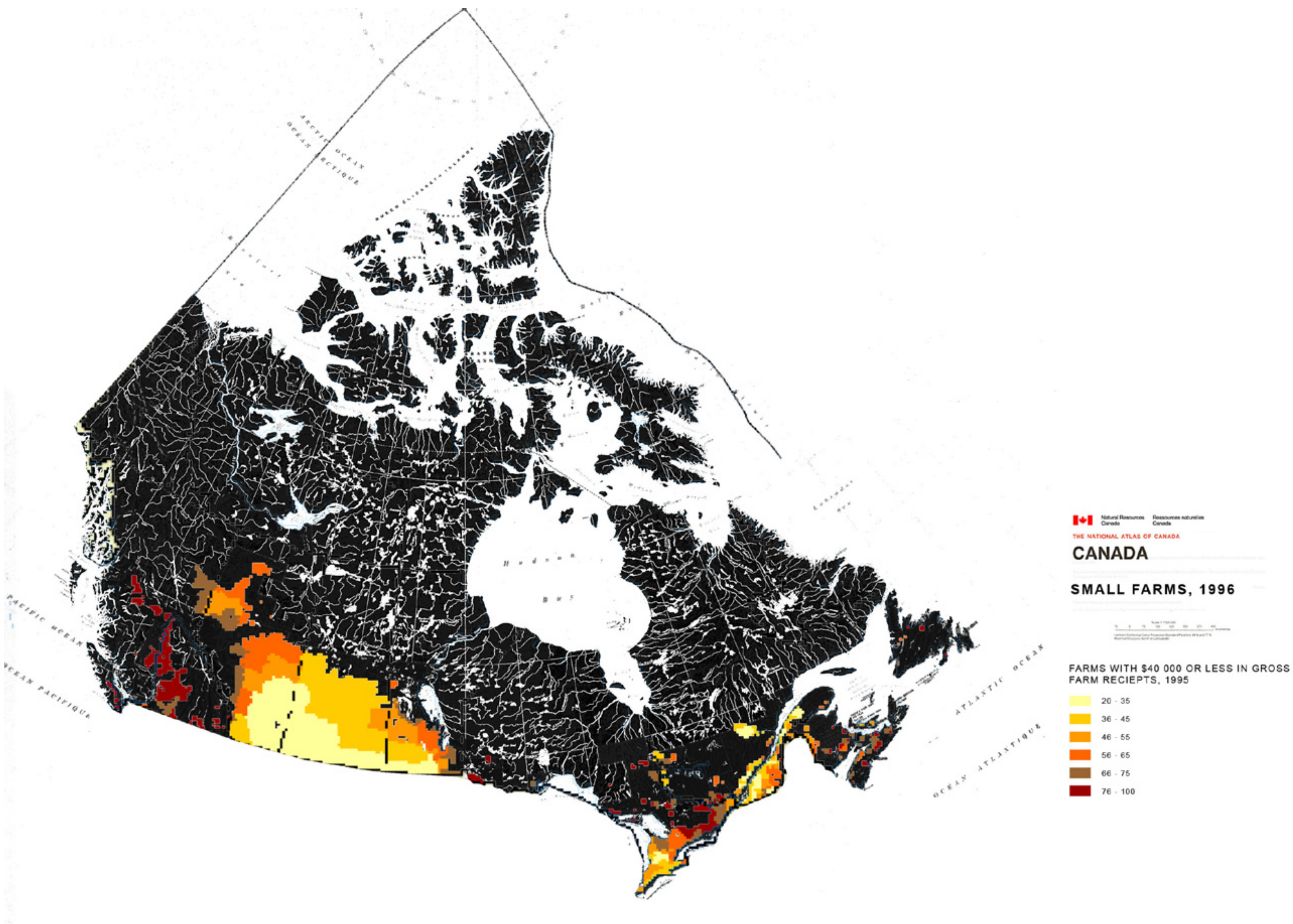

Natural Resources Canada
Ressources naturelles Canada
THE NATIONAL ATLAS OF CANADA
CANADA
SMALL FARMS, 1996
FARMS WITH $40 000 OR LESS IN GROSS FARM RECIEPTS, 1995
20 - 35
36 - 45
46 - 55
56 - 65
66 - 75
76 - 100
ARCTIC OCEAN
OCEAN ARCTIQUE
PACIFIC OCEAN
OCEAN PACIFIQUE
ATLANTIC OCEAN
OCEAN ATLANTIQUE

Fig8.10;

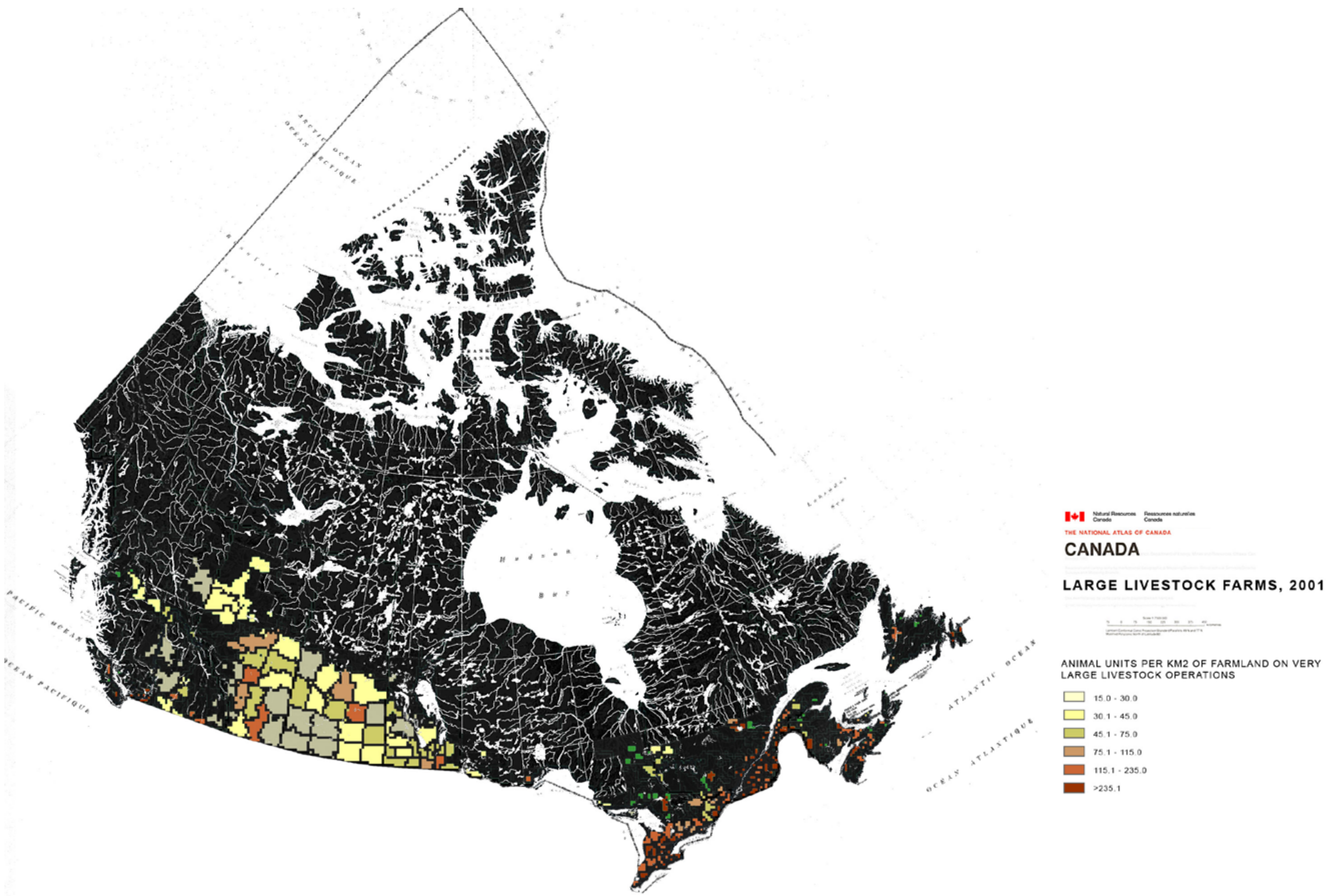

Natural Resources Canada
Ressources naturelles Canada
THE NATIONAL ATLAS OF CANADA
CANADA
LARGE LIVESTOCK FARMS, 2001
ANIMAL UNITS PER KM2 OF FARMLAND ON VERY LARGE LIVESTOCK OPERATIONS
15.0 - 30.0
30.1 - 45.0
45.1 - 75.0
75.1 - 115.0
115.1 - 235.0
>235.1
ARCTIC OCEAN
OCEAN ARCTIQUE
PACIFIC OCEAN
OCEAN PACIFIQUE
ATLANTIC OCEAN
OCEAN ATLANTIQUE

Fig8.11;

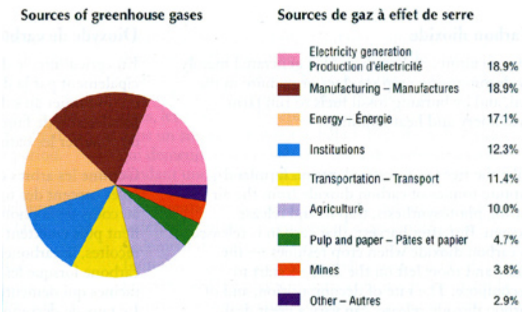


Fig8.12; Sources of greenhouse gasses.

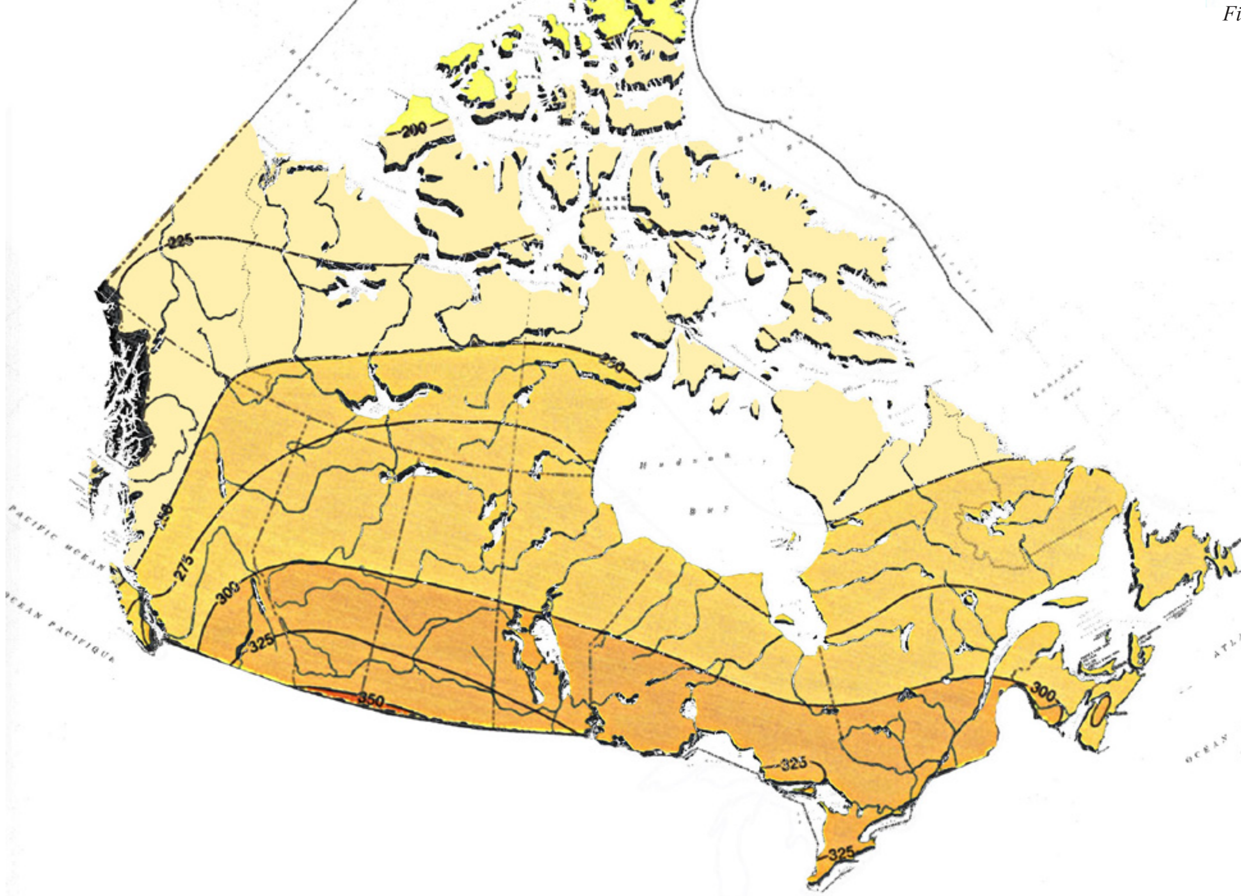


Fig8.13;

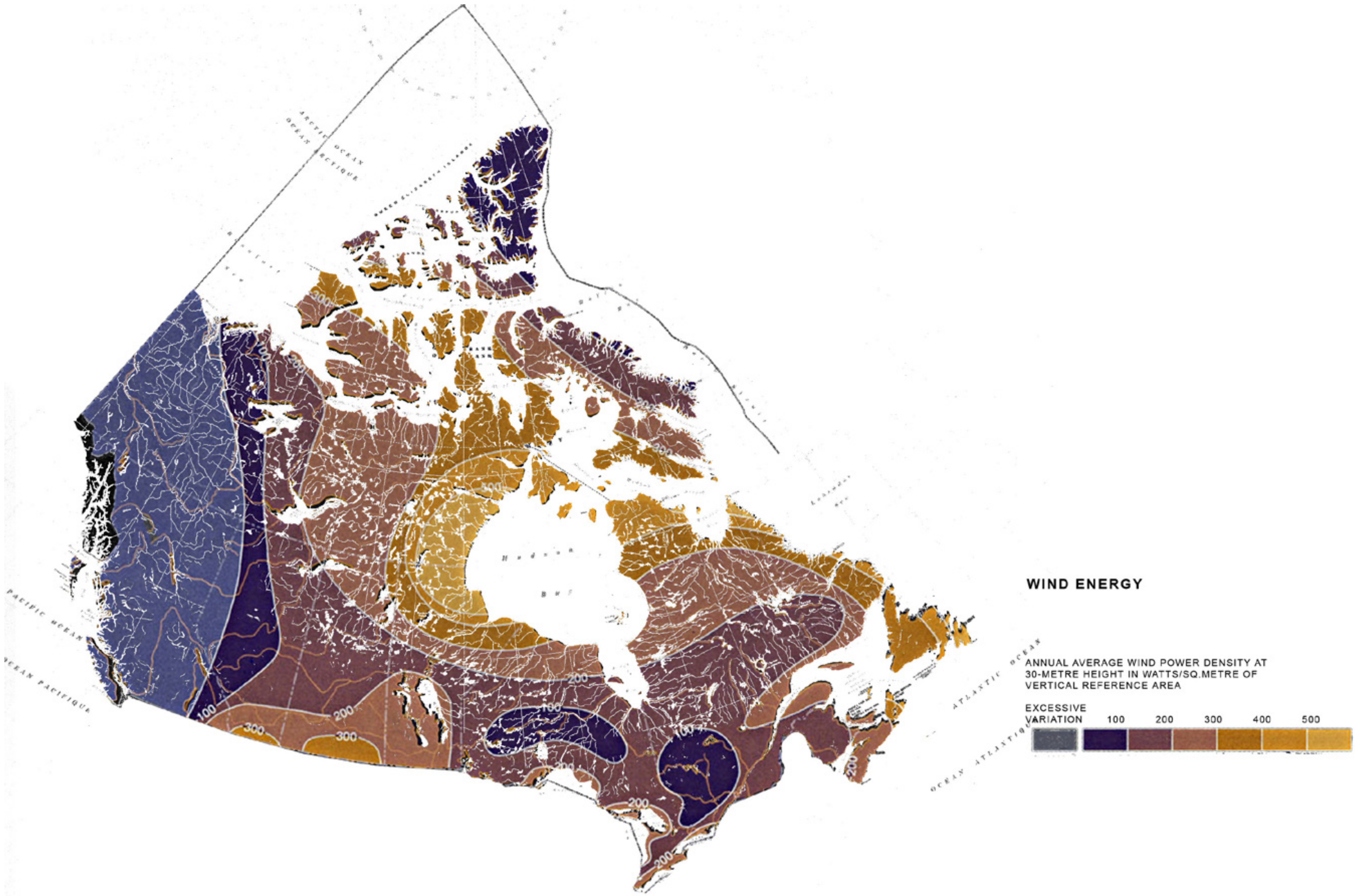

WIND ENERGY
ANNUAL AVERAGE WIND POWER DENSITY AT
30-METRE HEIGHT IN WATTS/SQ.METRE OF
VERTICAL REFERENCE AREA
EXCESSIVE
VARIATION
100
200
300
400
500
PACIFIC OCEAN
OCEAN PACIFIQUE
ATLANTIC OCEAN
OCEAN ATLANTIQUE
ARCTIC OCEAN
OCEAN ARCTIQUE

Fig8.14;

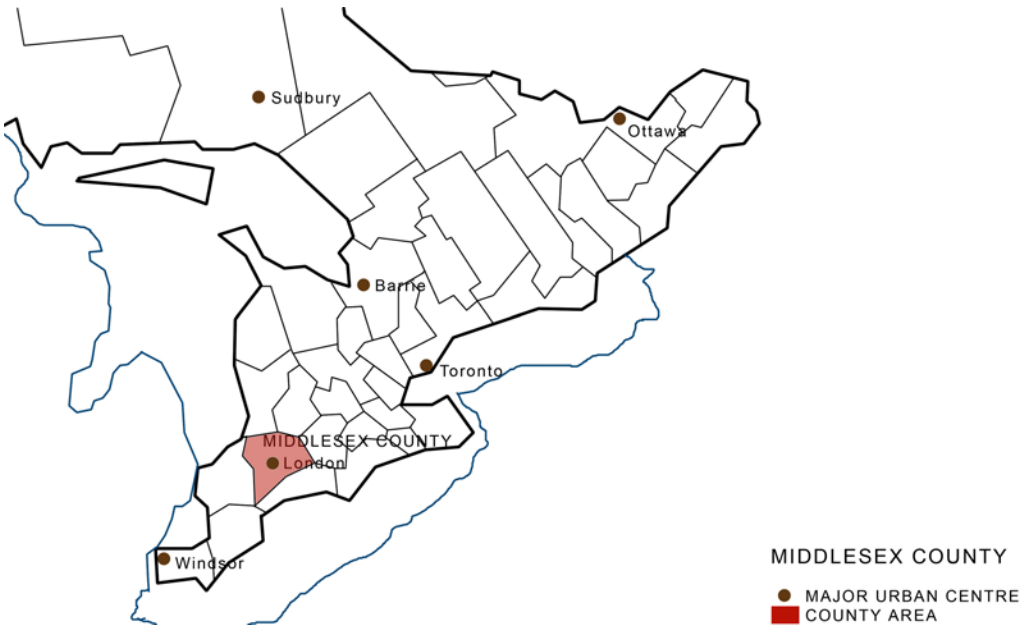
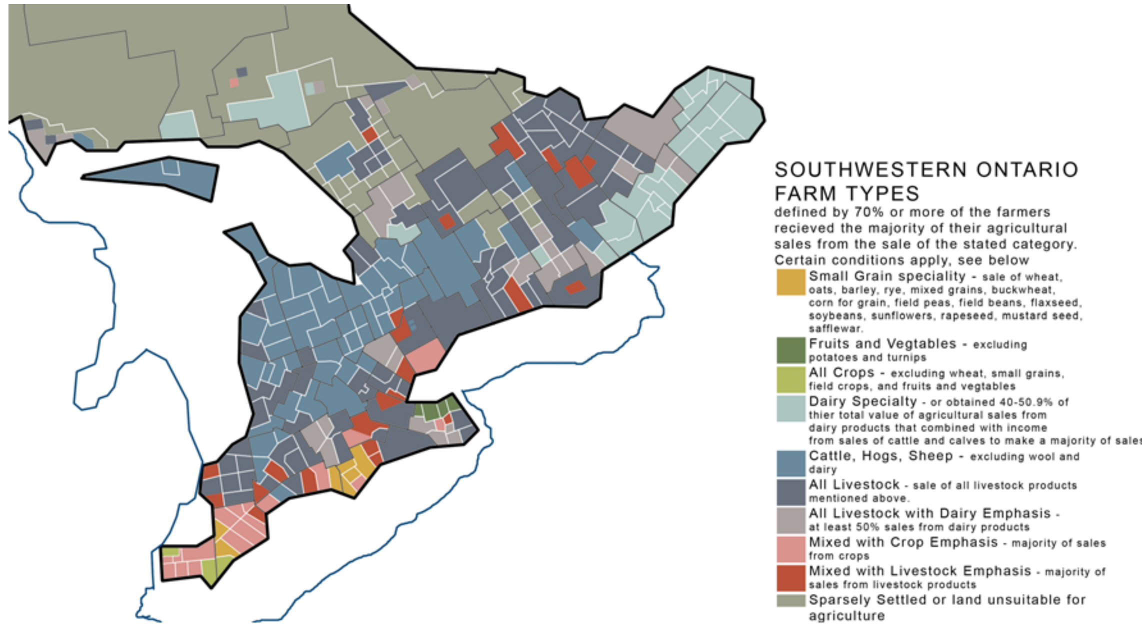


Fig8.15; Middlesex County in relation to Southwestern Ontario.

Fig8.16; Ontario has a diverse range of farm types.



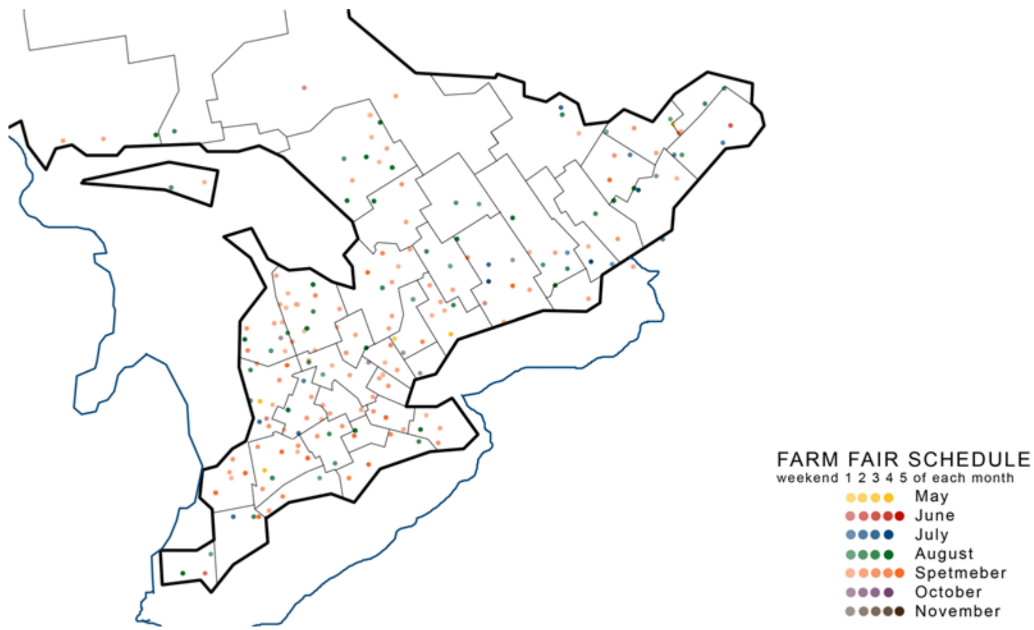


Fig8.17; Farm fairs scatter the province all spring, summer, and fall.

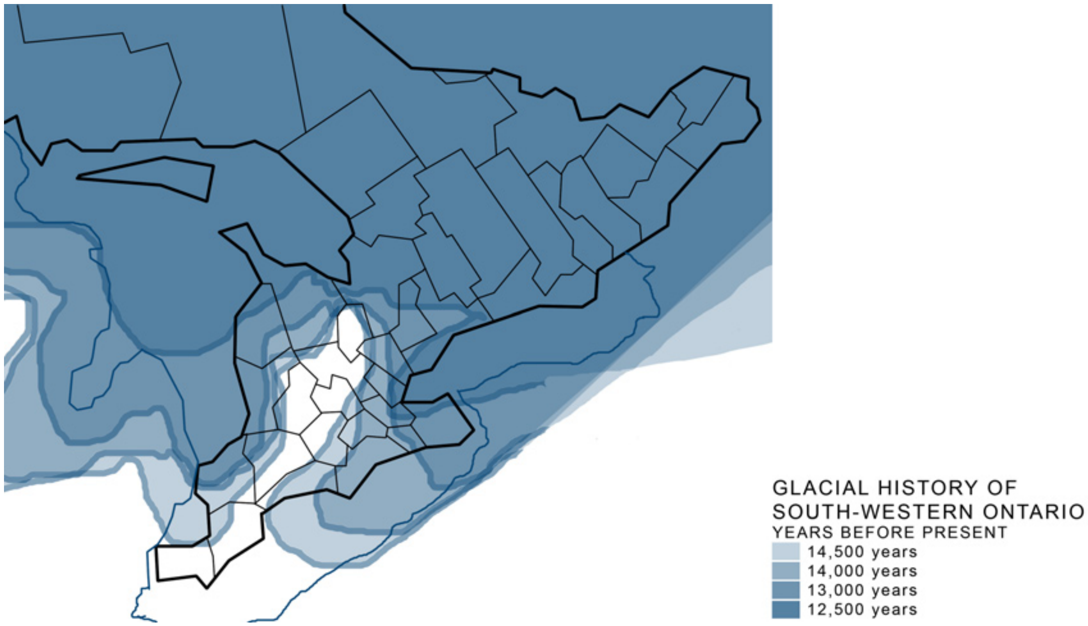


Fig8.18;

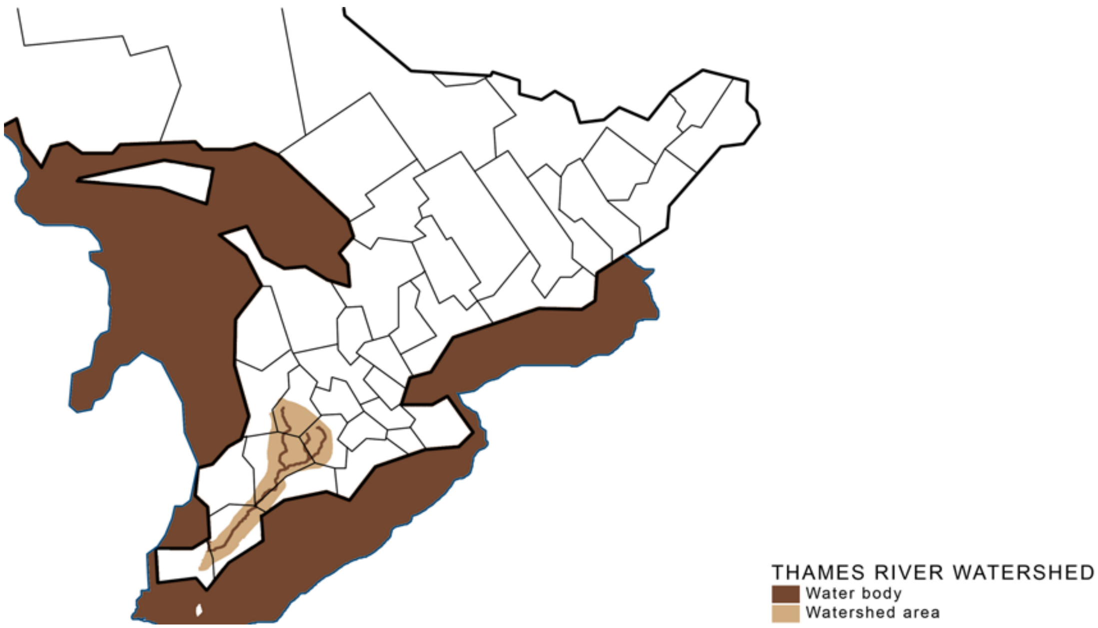
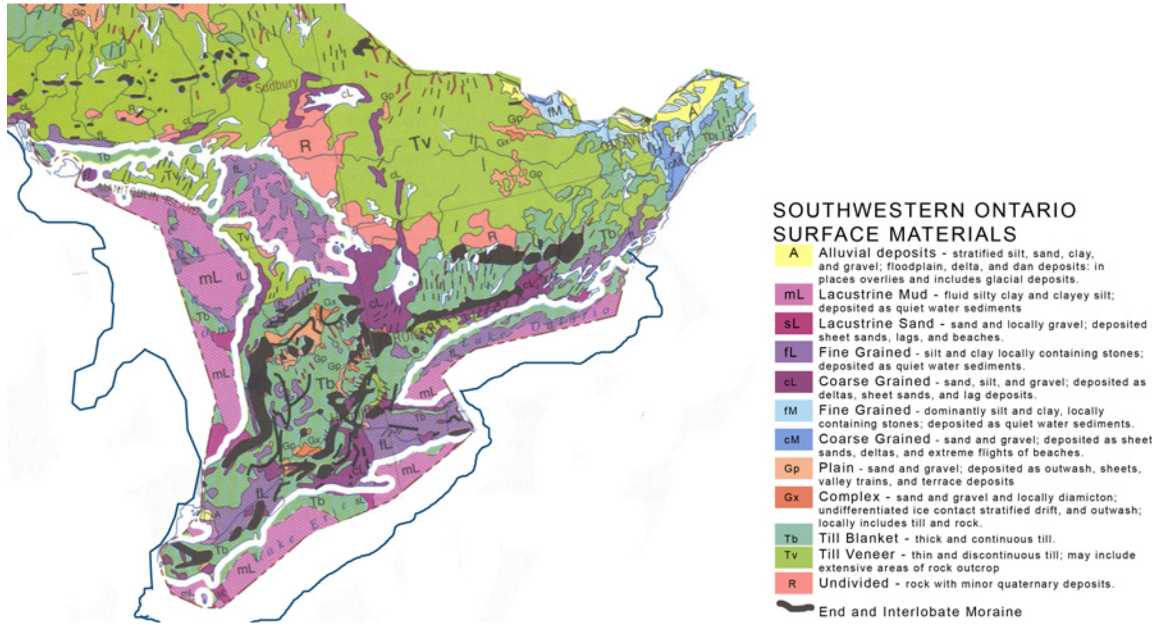


Fig8.19;

Fig8.20;


SOUTHWESTERN ONTARIO
SURFACE MATERIALS
A Alluvial deposits - stratified silt, sand, clay, and gravel; floodplain, delta, and dan deposits: in places overlies and includes glacial deposits.
mL Lacustrine Mud - fluid silty clay and clayey silt; deposited as quiet water sediments
sL Lacustrine Sand - sand and locally gravel; deposited a sheet sands, lags, and beaches.
fL Fine Grained - silt and clay locally containing stones; deposited as quiet water sediments.
cL Coarse Grained - sand, silt, and gravel; deposited as deltas, sheet sands, and lag deposits.
fM Fine Grained - dominantly silt and clay, locally containing stones; deposited as quiet water sediments.
cM Coarse Grained - sand and gravel; deposited as sheet sands, deltas, and extreme flights of beaches.
Gp Plain - sand and gravel; deposited as outwash, sheets, valley trains, and terrace deposits
Gx Complex - sand and gravel and locally diamicton; undifferentiated ice contact stratified drift, and outwash; locally includes till and rock.
Tb Till Blanket - thick and continuous till.
Tv Till Veneer - thin and discontinuous till; may include extensive areas of rock outcrop
R Undivided - rock with minor quaternary deposits.
End and Interlobate Moraine

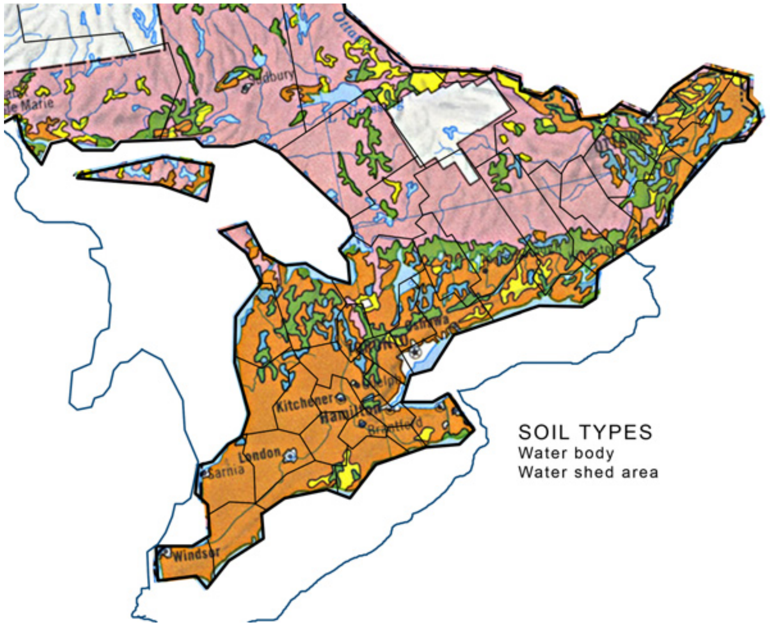


Fig8.21;

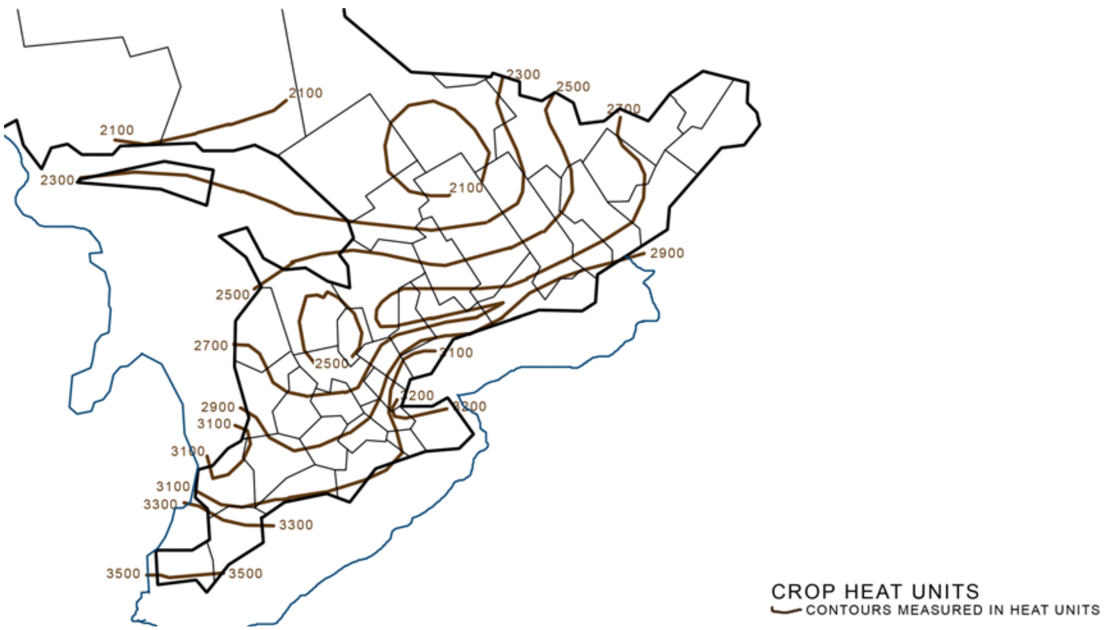
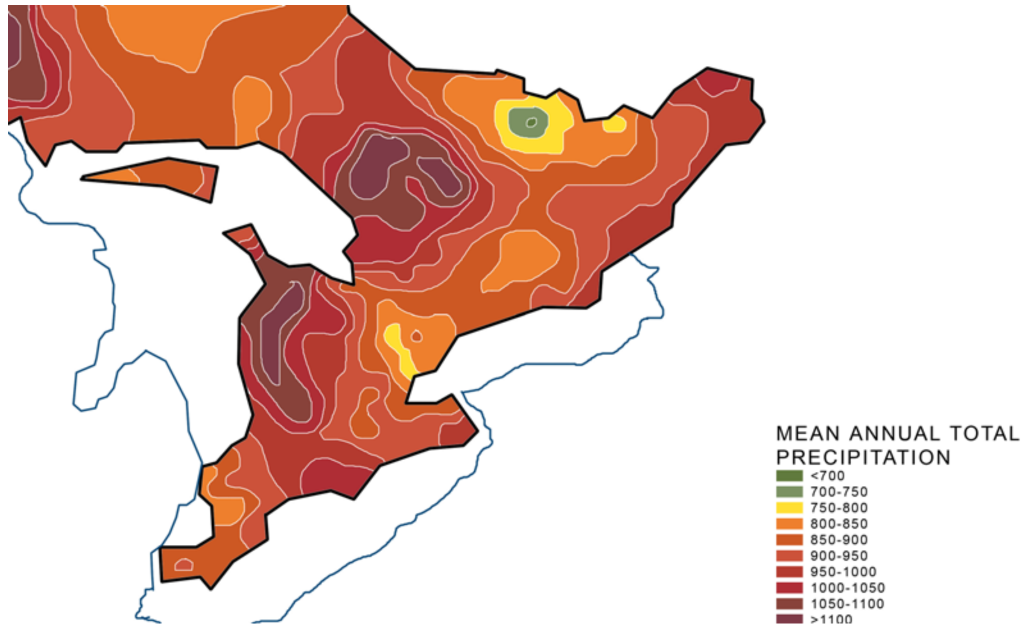


Fig8.22;

Fig8.23;



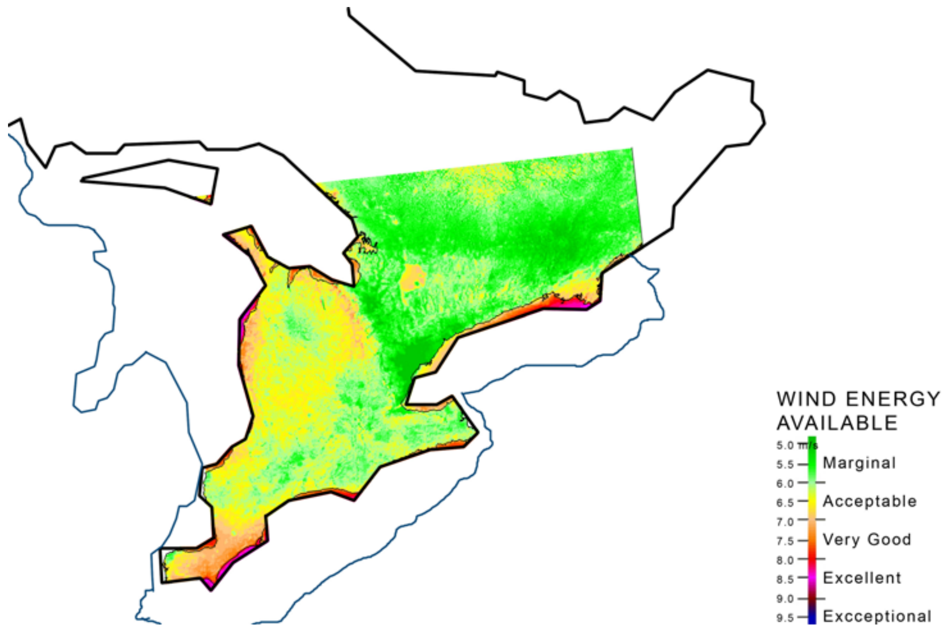
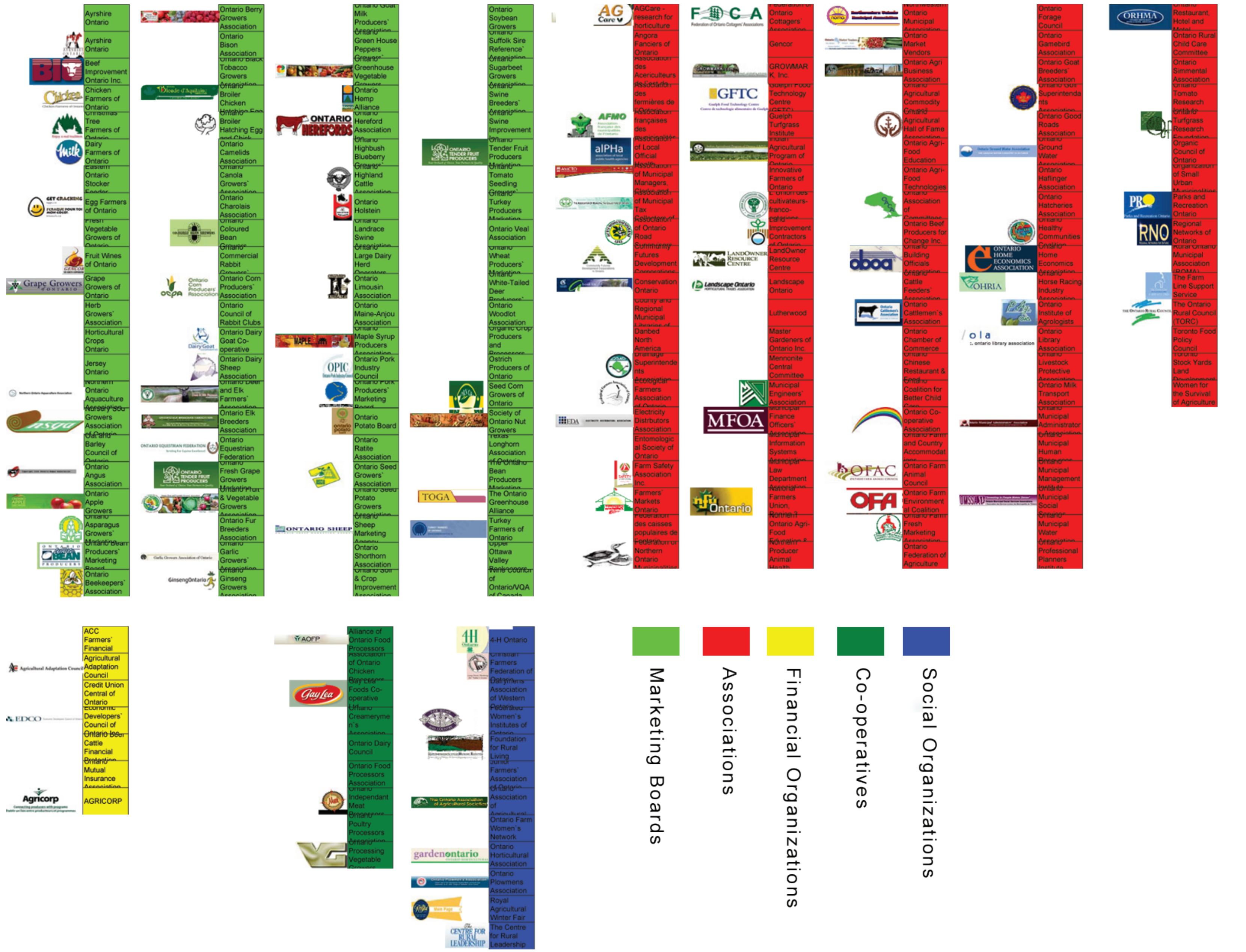


Fig8.24;

Fig8.25; The Marketing Boards and Associations play a major role in the social shape of the rural culture. Most boards are run by farm owners, and many are co-operatives. There are also many social groups for all ages in rural culture.


Marketing Boards
Associations
Financial Organizations
Co-operatives
Social Organizations
Ayrshire Ontario
Beef Improvement Ontario Inc.
Chicken Farmers of Ontario
Dairy Farmers of Ontario
Egg Farmers of Ontario
Fruit Wines of Ontario
Grape Growers of Ontario
Herb Growers Association
Horticultural Crops Ontario
Jersey Ontario
Ontario Apple Growers
Ontario Asparagus Growers
Ontario Beekeepers' Association
Ontario Berry Growers Association
Ontario Bison Association
Ontario Broiler Chicken
Ontario Camelids Association
Ontario Canola Growers
Ontario Charolais Association
Ontario Coloured Bean
Ontario Corn Producers' Association
Ontario Council of Ontario Rabbit Clubs
Ontario Dairy Goat Co-operative
Ontario Dairy Sheep Association
Ontario Elk Breeders Association
Ontario Equestrian Federation
Fresh Grape Growers
Ontario Fur Breeders Association
Ontario Garlic Growers
Ontario Ginseng Growers
Green House Peppers
Ontario Greenhouse Vegetable
Ontario Hemp Alliance
Ontario Hereford Association
Ontario Highland Cattle
Ontario Holstein
Landrace Swine
Large Daily Herd
Ontario Limousin Association
Ontario Maine-Anjou Association
Ontario Maple Syrup Producers
Ontario Pork Industry Council
Ontario Potato Board
Ontario Ratite Association
Ontario Seed Growers' Association
Sheep Marketing
Ontario Shorthorn Association
Ontario Soybean Growers
Suffolk Sire Reference
Sugarbeet Growers
Swine Breeders
Swine Improvement
Tender Fruit Producers
Tomato Seedling
Turkey Producers
Ontario Veal Association
Wheat Producers'
White-Tailed Deer
Ontario Woodlot Association
Ostrich Producers of Ontario
Seed Corn Growers of Ontario
Society of Ontario Nut Growers
Longhorn Association
Bean Producers
The Ontario Greenhouse Alliance
Turkey Farmers of Ontario
Ottawa Valley
AGCare - research for horticulture
Angora Fanciers of Ontario
Conservation Ontario
Danbed North America
Electricity Distributors Association
Farm Safety Association Inc
Farmers Markets Ontario
Ontario Cottagers' Association
Gencor
GROWMARK, Inc.
Guelph Food Technology Centre
Guelph Turfgrass Institute
Innovative Farmers of Ontario
LandOwner Resource Centre
Landscape Ontario
Lutherwood
Master Gardeners of Ontario Inc
Mennonite Central Committee
Municipal Engineers Association
Municipal Finance Officers'
Municipal Law Department
Farmers Union
Ontario Agri-Food
Ontario Municipal Association
Ontario Market Vendors
Ontario Agri Business Association
Ontario Agricultural Commodity Council
Ontario Agricultural Hall of Fame
Ontario Agri-Food Education
Ontario Agri-Food Technologies
Ontario Beef Producers for Change Inc.
Ontario Building Officials
Ontario Cattle Feeders' Association
Ontario Cattlemen's Association
Ontario Chamber of Commerce
Chinese Restaurant &
Coalition for Better Child Care
Ontario Co-operative Association
Ontario Farm Animal Council
Ontario Farm Environment al Coalition
Fresh Marketing
Ontario Federation of Agriculture
Ontario Forage Council
Ontario Gamebird Association
Ontario Goat Breeders' Association
Ontario Good Roads Association
Ground Water
Ontario Haflinger Association
Ontario Hatcheries Association
Healthy Communities
Home Economics
Horse Racing Industry
Ontario Institute of Agrologists
Ontario Library Association
Livestock Protective
Ontario Milk Transport Association
Municipal Administrator
Municipal Human
Municipal Management
Municipal Social
Municipal Water
Professional Planners
Restaurant, Hotel and Motel
Ontario Rural Child Care Committee
Ontario Simmental Association
Tomato Research
Turfgrass Research
Organic Council of Ontario
Parks and Recreation Ontario
Regional Networks of Ontario
Municipal Association
The Farm Line Support Service
The Ontario Rural Council (TORC)
Toronto Food Policy Council
Stock Yards Land
Women for the Survival of Agriculture
ACC Farmers' Financial
Agricultural Adaptation Council
Credit Union Central of Ontario
Developers' Council of Ontario
Cattle Financial
Mutual Insurance
AGRICORP
Alliance of Ontario Food Processors
Ontario Chicken
Foods Co-operative
Creameryme n's
Ontario Dairy Council
Ontario Food Processors Association
Independant Meat
Poultry Processors
Processing Vegetable
4-H Ontario
Farmers Federation of
Association of Western
Women's Institutes of
Foundation for Rural Living
Farmers' Association
Association of
Ontario Farm Women's Network
Ontario Horticultural Association
Ontario Plowmens Association
Royal Agricultural Winter Fair
The Centre for Rural Leadership

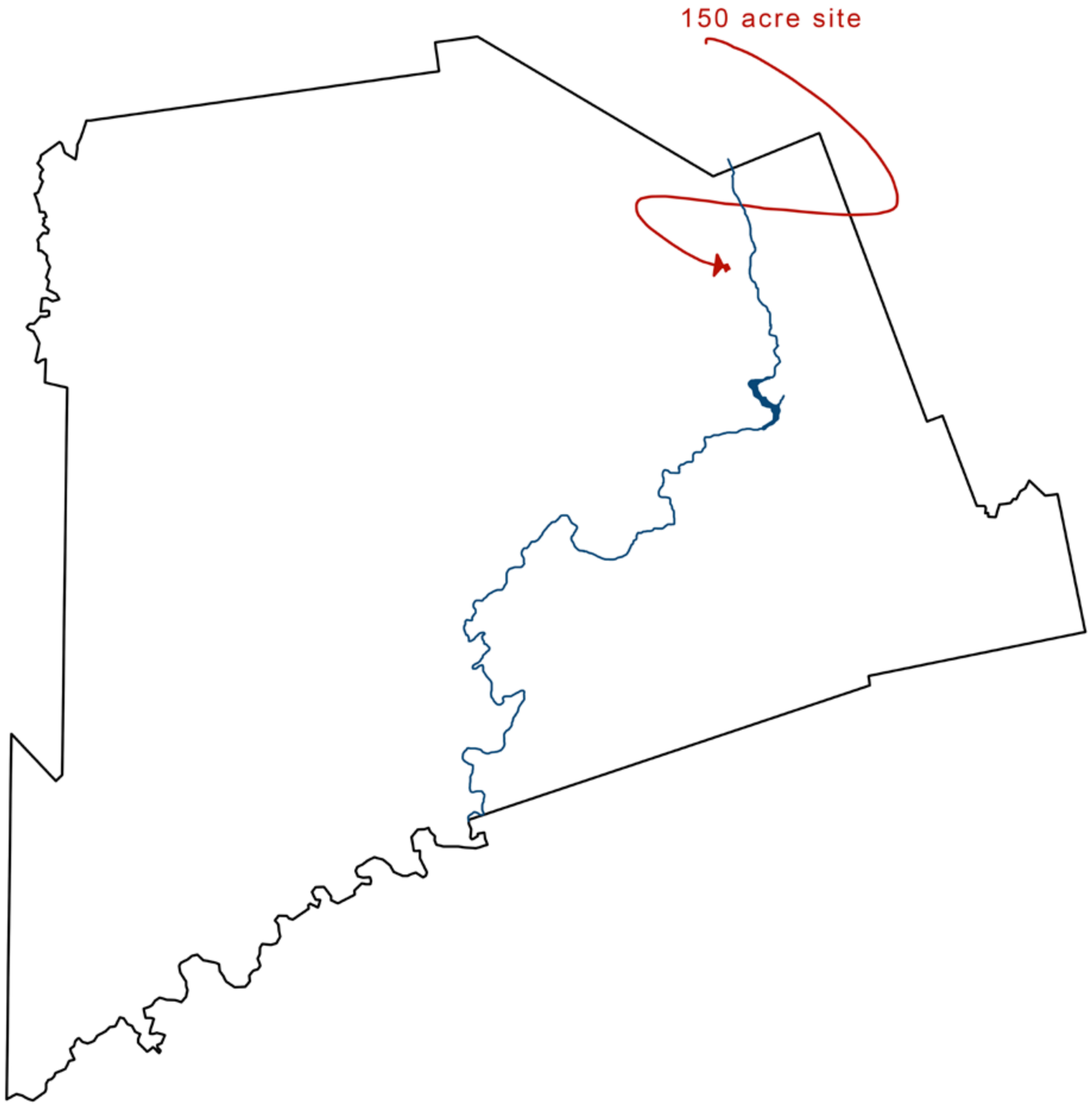


Fig8.26; The Sustainable Family Farmstead in relation to Middlesex County.

MIDDLESEX COUNTY

Abiotic

The following conditions are not controllable. The climate conditions determine where farming takes place in the world and what type. Middlesex County is ideal soil and sun conditions for grain crops. Although there is variation within Middlesex and some areas are good for vegetables, other for only pasture lands. These diagrams show how a farm must master and overcome nature. Wind protection is needed from west winds, drainage of the site is to the west, and solar gain is from south exposure. Farming accepts and then fights against the abiotic conditions of a site.

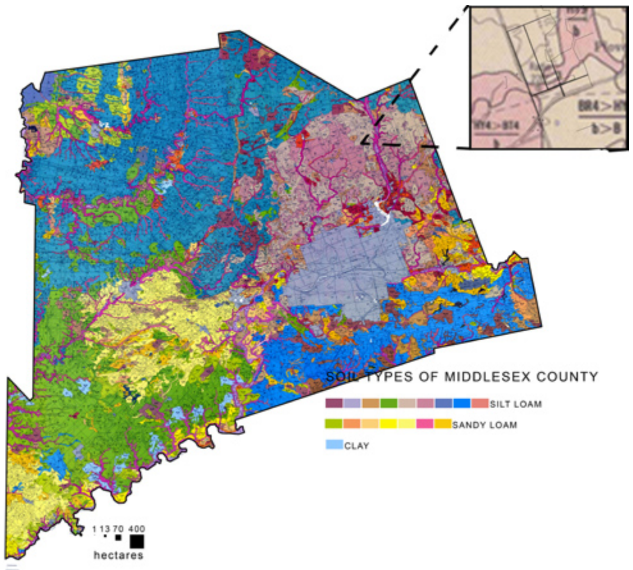


Fig8.27; The Sustainable Family Farmstead has Honeywell and Bryanston soils, which are silt loam. Loams are ideal for crop growing because they drain at an ideal rate, not collecting water and not washing away nutrients.

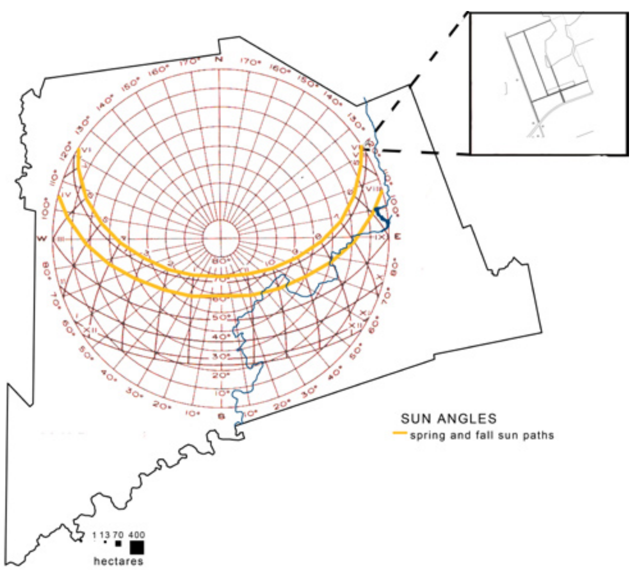
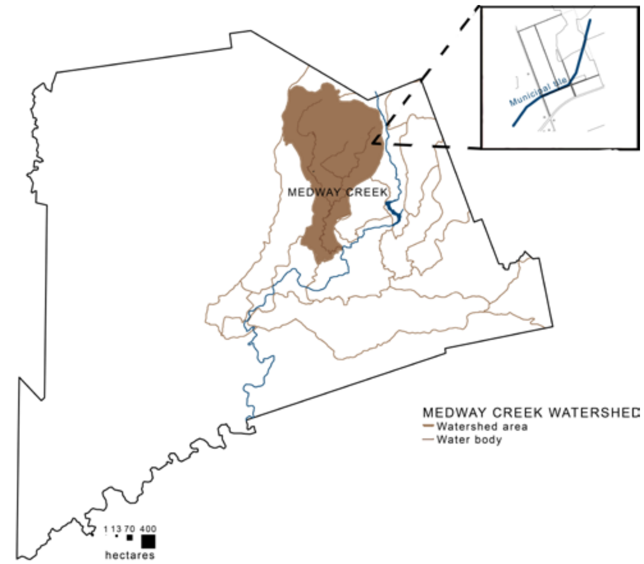


Fig8.28; The Sustainable Family Farmstead receives south sun exposure.

Fig8.29; The Sustainable Family Farmstead drains into the Medway creek to the west of the site. Drainage is important to understand because it determines where wells, manure, and other things affected by runoff, should be located on the farm.



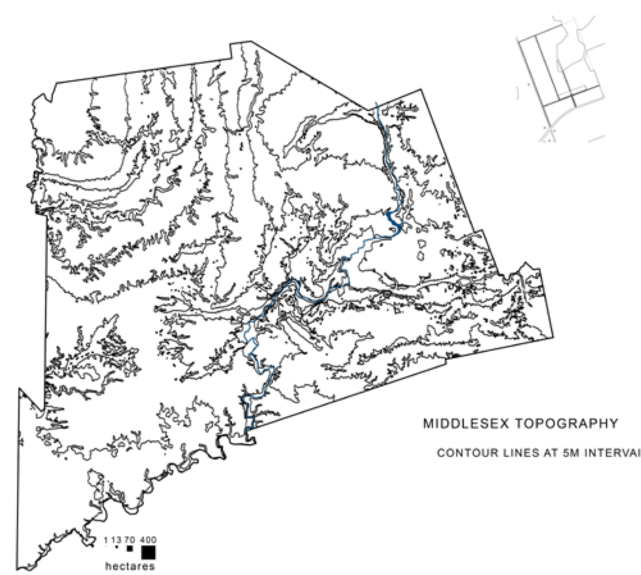


Fig8.30; The topography of Middlesex County is relatively flat, with a few major features.

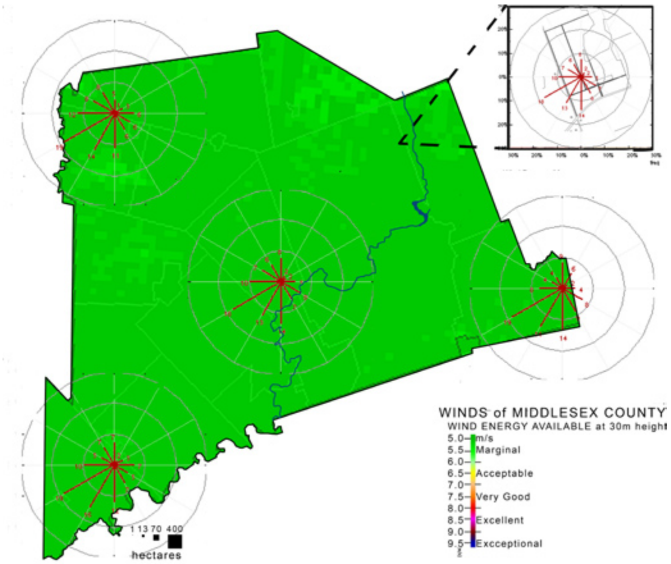


Fig8.31; At a 30 meter height Middlesex and the farm site have marginal wind energy available. This means a wind turbine cannot be the sole source of electricity for the farm.

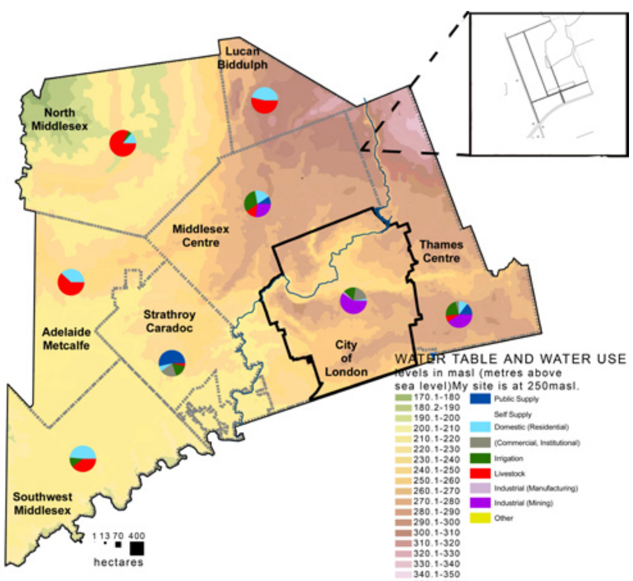


Fig8.32; The water used in the country is mostly used for livestock except for the city of London.

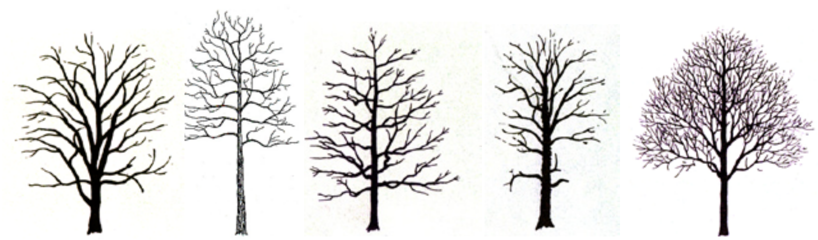
Biotic

Some of the native species were studied to determine ideal combinations for the pastures and orchards. Using native species helps an ecosystem work to its maximum potential as the species are designed to survive best in those conditions.

Fig8.33; Native trees of Middlesex County; black walnut, dogwood, sassafras, nothern hackberry

Fig8.34; Native grasses chosen for the pastures; aster, tick trefoil, switch grass, big bluestream, Canadian rye, indian grass, bush clover

Fig8.35; Native trees chosen for the pastures; butternut, chestnut, white oak, shagbark hickory, hop hornbeam

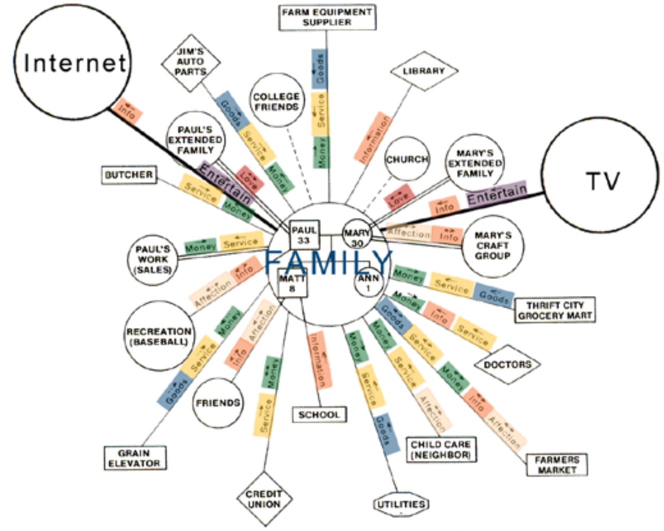


Cultural

The following cultural conditions have a long history. The concession system has slowly evolved over time as the dynamics of people in rural Middlesex County have changed. As people moved to the country land was subdivided and as people left for the city the lots were consolidated again and farm size grew. These maps describe the conditions and neighborhood scale of one 150acre farm; how far away the grocery store and farm supply store is, what type of farm the neighbor is, and where the nearest town is. They also describe the decline of the farming population by the number of retired farmers living on farmland and renting the land to neighbors.

Economical structures are also depicted in the three scales of farm and the marketing boards which govern the farm community.

Fig8.36; This family ecosystem describes the neighbors, services, and social groups that are needed by one farm family. Internet and television are added into this system as a sources of information, entertainment and communication.



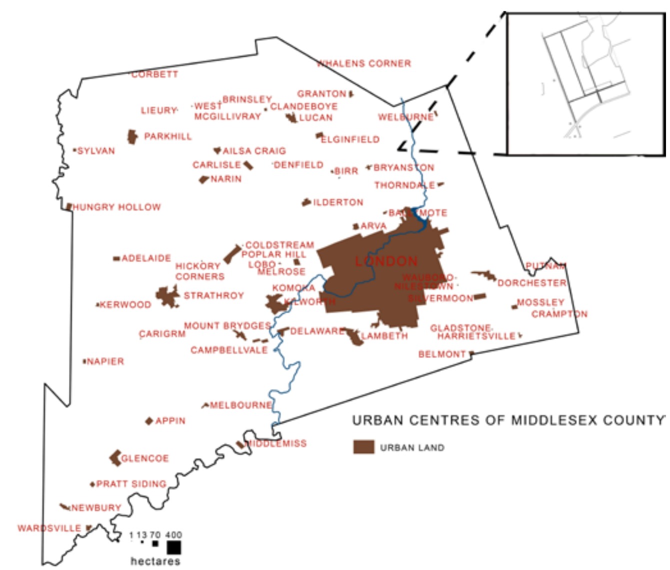


Fig8.37; This map describes the urban canters in Middlesex County. These towns range in size from a population of 35,000 in London and 4 in Elginfield. These places have mostly formed around intersections. They have evolved over history. Some places have grown and prospered, while some places remain only because of the name.

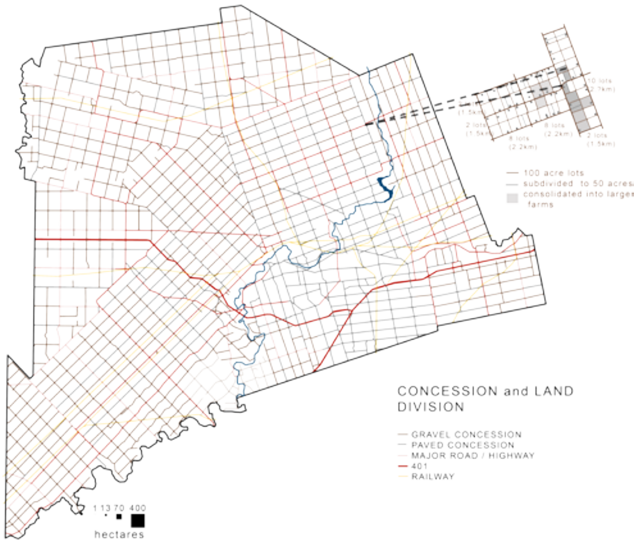


Fig8.38; This map describes the road types, and how the county has evolved. Paved roads and highways connect the major urban centers and describe where most people travel to and from. The evolution of land division is described in the corner. Each concession is 2.2km by 1.5km. This space is divided into four lots. Some lots were subdivided into 50 acre lots. In recent history many properties have been amalgamated into large land holdings of 400 acres.

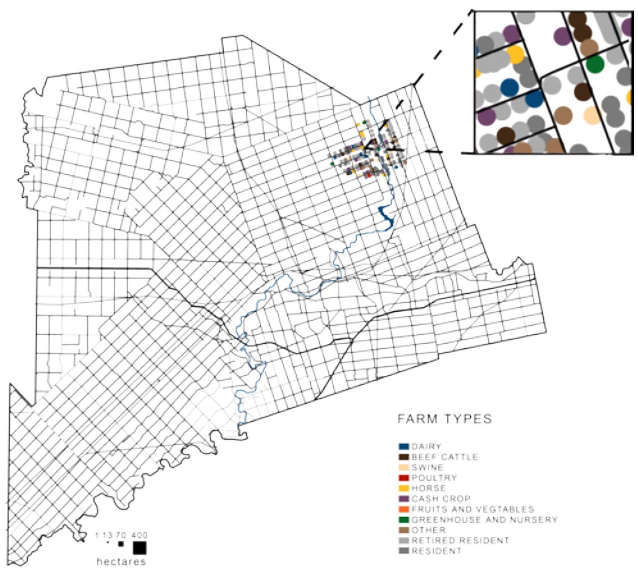
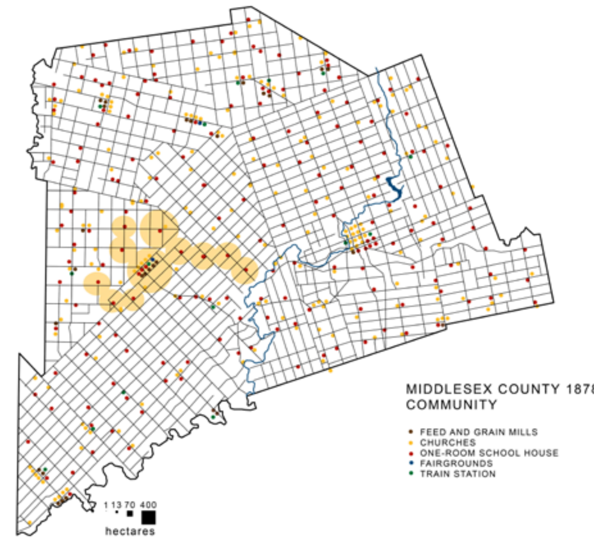


Fig8.39; This map of farm types shows that the majority of residents in rural areas are not farmers, or are retired farmers living on farm sites who rent land to neighbors. From this small sample of Middlesex County a very large portion of residents are retired because their children chose not to take over the farm.

Fig8.40; The ecosystem described previously is mapped for Middlesex County in 1878. There is a church and a schoolhouse every two concession blocks.



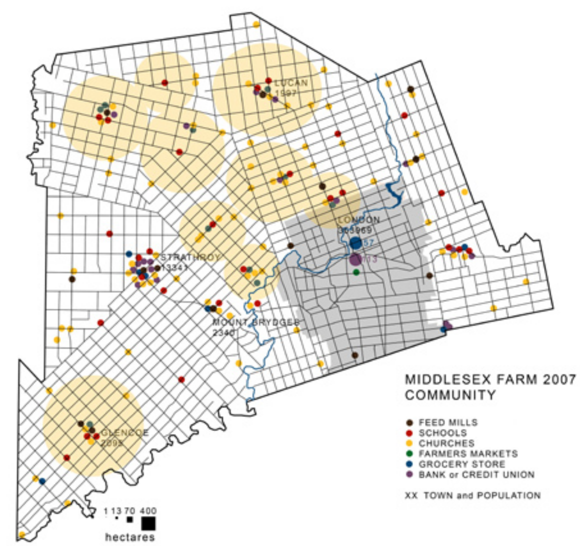


Fig8.41; The ecosystem described on page 195 is mapped for Middlesex County. Most services are located in the urban centers. Most of the small towns have a church. This is the main social event of farm culture. However, church going has been decreasing over the past 100 years. There needs to be an event and gathering space which replaces the church to encourage rural culture.

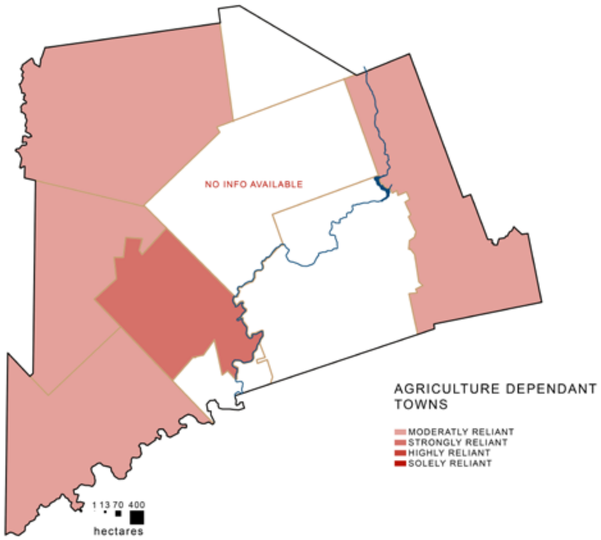


Fig8.42; This map describe which townships are still dependant on agriculture for its economic success.

Human Built

The current state of farm buildings is compared with the vernacular types of pre 1900s. Processes between the eras have not changed but the methods have through mechanization. The next stage of farm buildings will be a sustainable one.

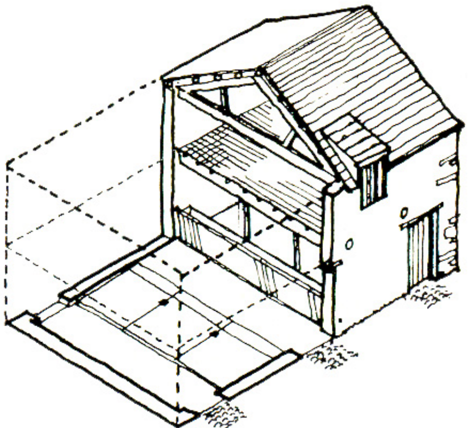
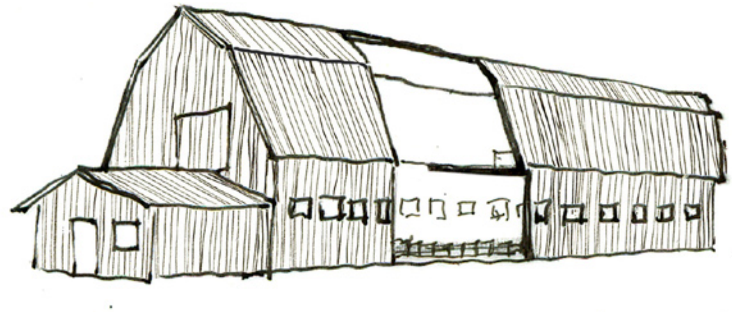
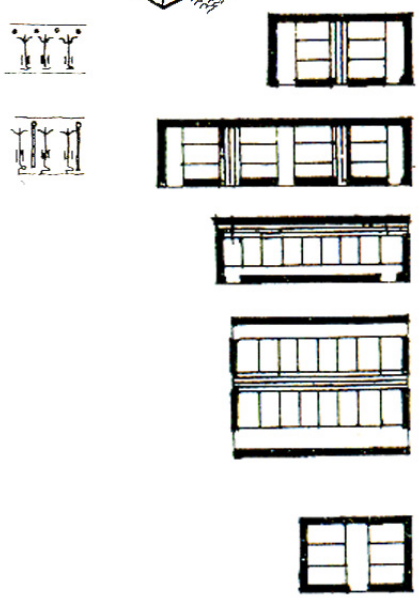
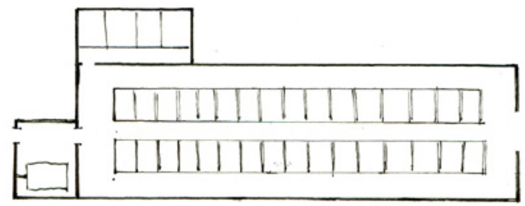


Fig8.43; Cow House to Dairy Barn
Purpose: to shelter animals and people as cows are milked

What Changed:
-milking machine
-Separate milk house
-Larger herds







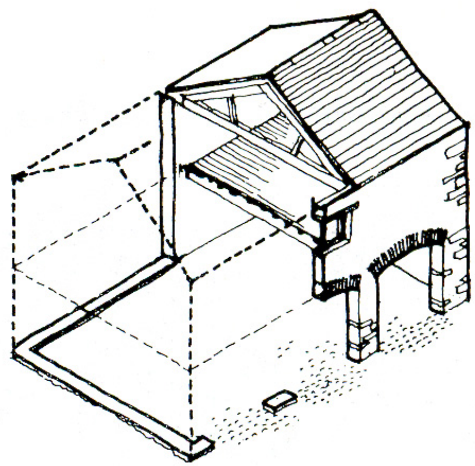
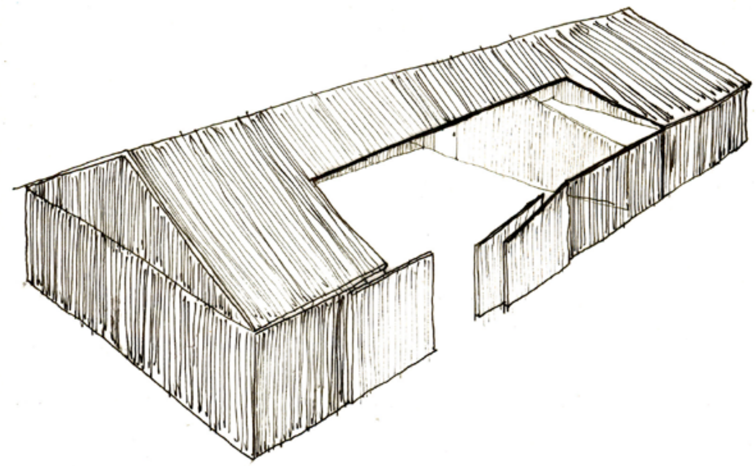
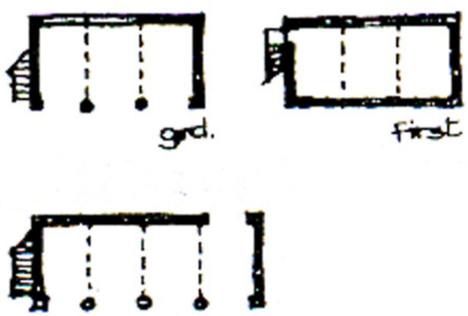


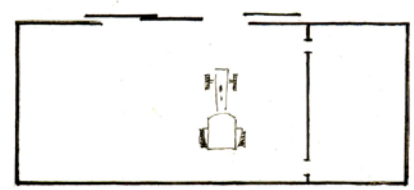
Fig8.44; Cart Shed to Drive Shed

Purpose: store machinery away from the elements

What Changed:
horse to tractor, multiplied horse power







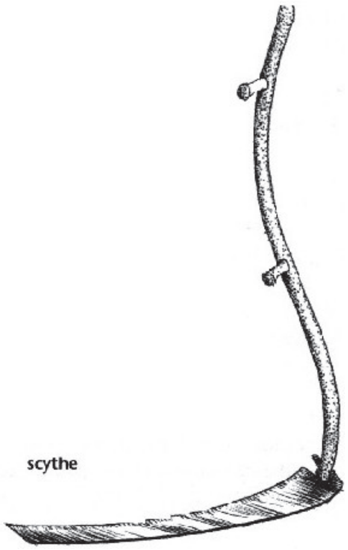


Fig8.45; Thrashing Barn to Combine
Purpose: space for taking the grain off the stalks and cobs

What Changed:
-hand scythe thrashing to a machine harvester and thrasher
-No longer a building

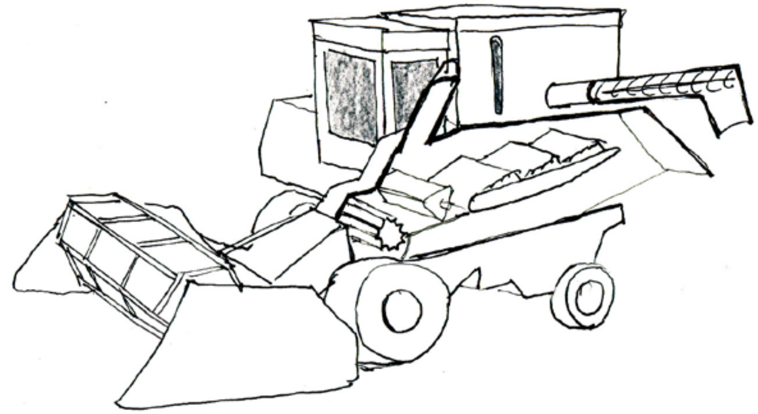
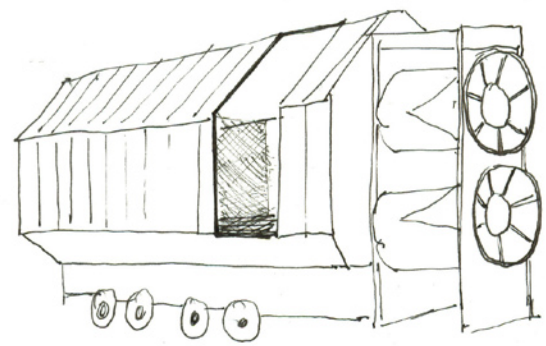


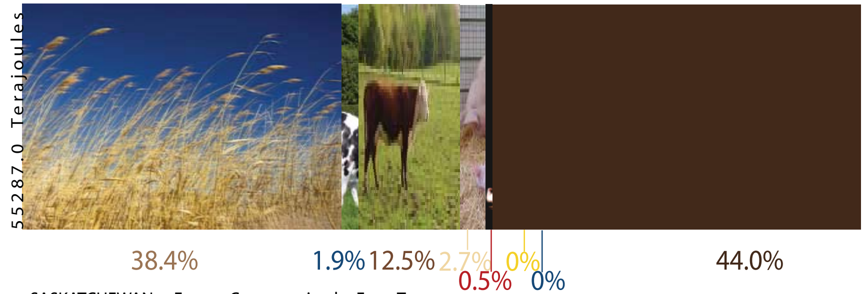
Fig8.46; Corn Crib to Corn Dryer
Purpose: to ventilate the corn from drying

What Changed:
-whole cob harvesting to kernel harvesting
-No longer able to harvest cobs
-Natural ventilation to a controlled fan

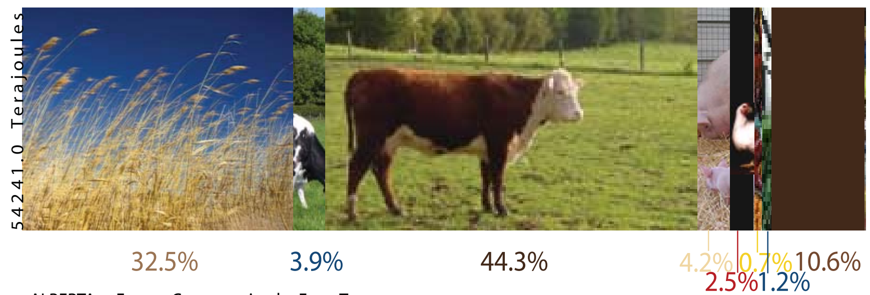


Energetics

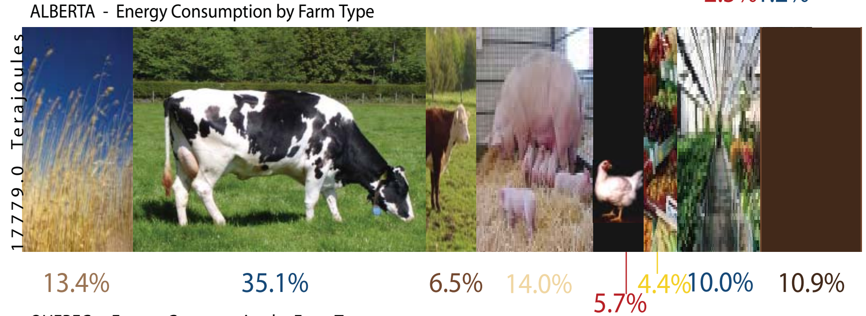
There is a continuous flow of energy through a farm operation, starting with converting the suns energy into food energy. In the following diagrams energy is tracked and waste energy is found in many processes. More efficient processes can also be found.



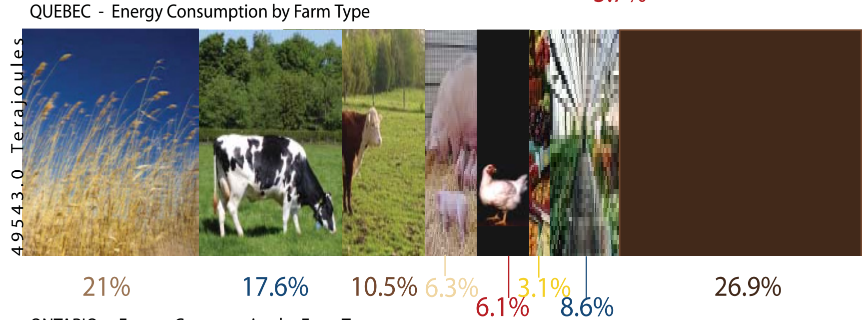
SASKATCHEWAN - Energy Consumption by Farm Type



ALBERTA - Energy Consumption by Farm Type



QUEBEC - Energy Consumption by Farm Type



ONTARIO - Energy Consumption by Farm Type

Fig8.47;

SASKATCHEWAN - Energy Consumption by Farm Use

ALBERTA - Energy Consumption by Farm Use

QUEBEC - Energy Consumption by Farm Use

ONTARIO - Energy Consumption by Farm Use

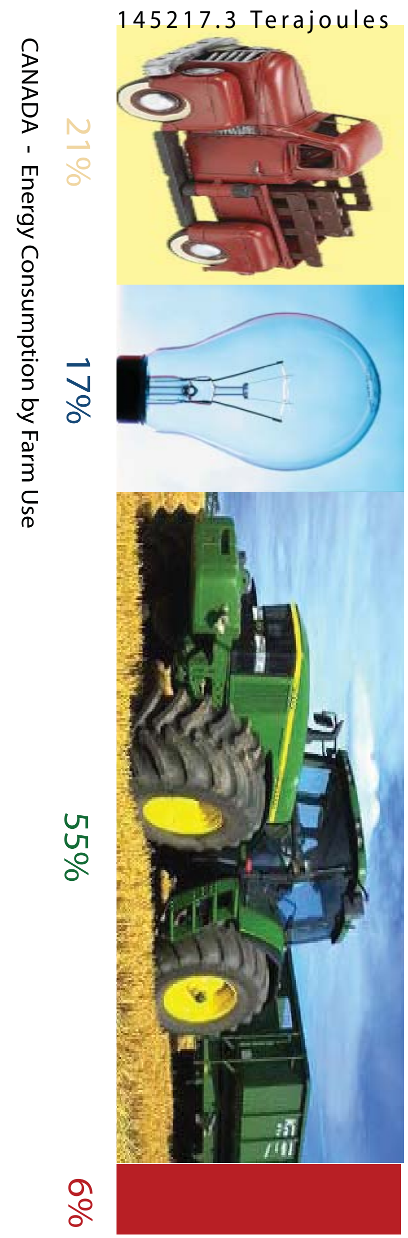


Fig8.48;

Legend:
Note: the following animals and crops are based on 1.59 hectares of land space.
All numbers are in mega calories unless otherwise noted.
Inputs:
Brown = feed and nutrient energy required
Green = electric, gas, machinery energy required
Blue = amount of water required
Yellow = amount of heat energy required
Pink = man hours required

Outputs:
Yellow = energy potential gained
Green = income gained
Brown = protein gained

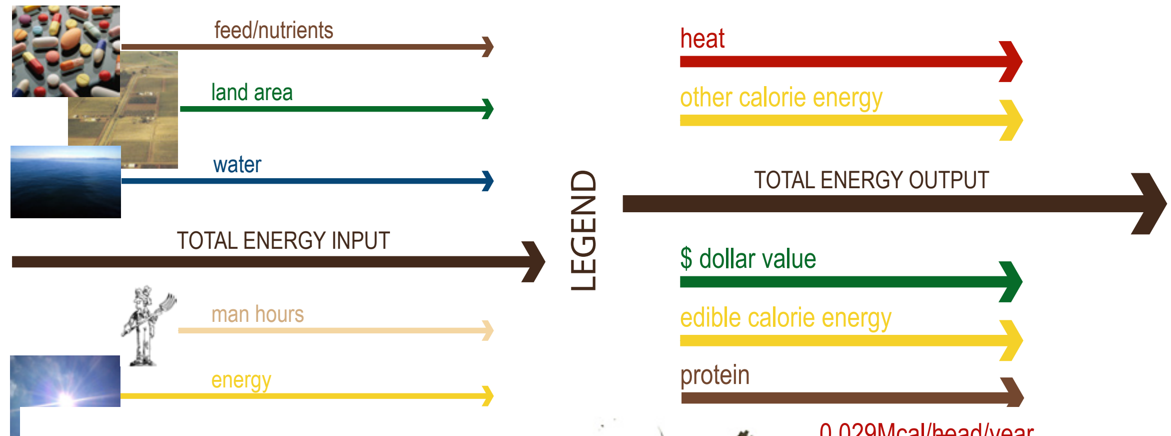


Fig8.49; A dairy cow produces the most amount of protein per year by 47373066g of protein. However a dairy cow is least efficient for amount of calorie energy gained of the four crops. A dairy cow also produces heat energy through manure and milk. These are cooled from 39 degrees (animal's body temperature) and have 648.029 megacalories per animal per year.

Fig8.50; Alfalfa is the most efficient crop of the following three. It has the largest calorie gain and second largest protein gain. Alfalfa is not digestible by humans in the mature form. Hay is fed to cows and digested by them. The bales of hay can be stored in a way to provide insulation and a wind break for the barn.

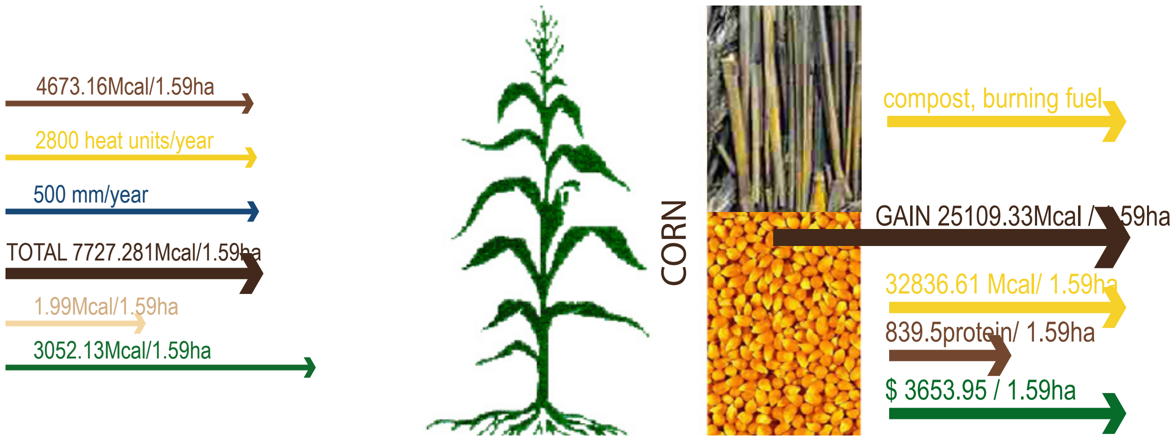
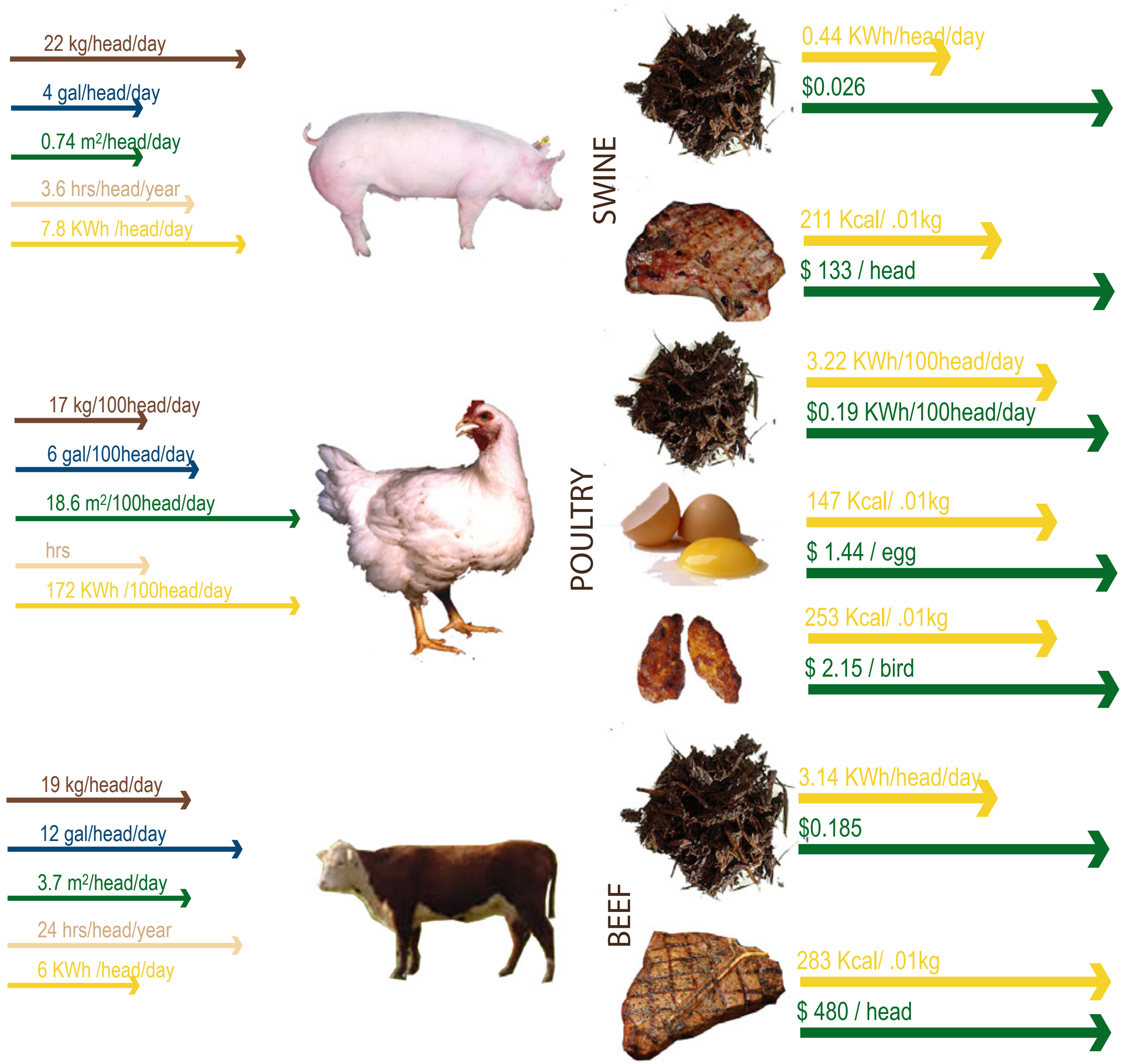
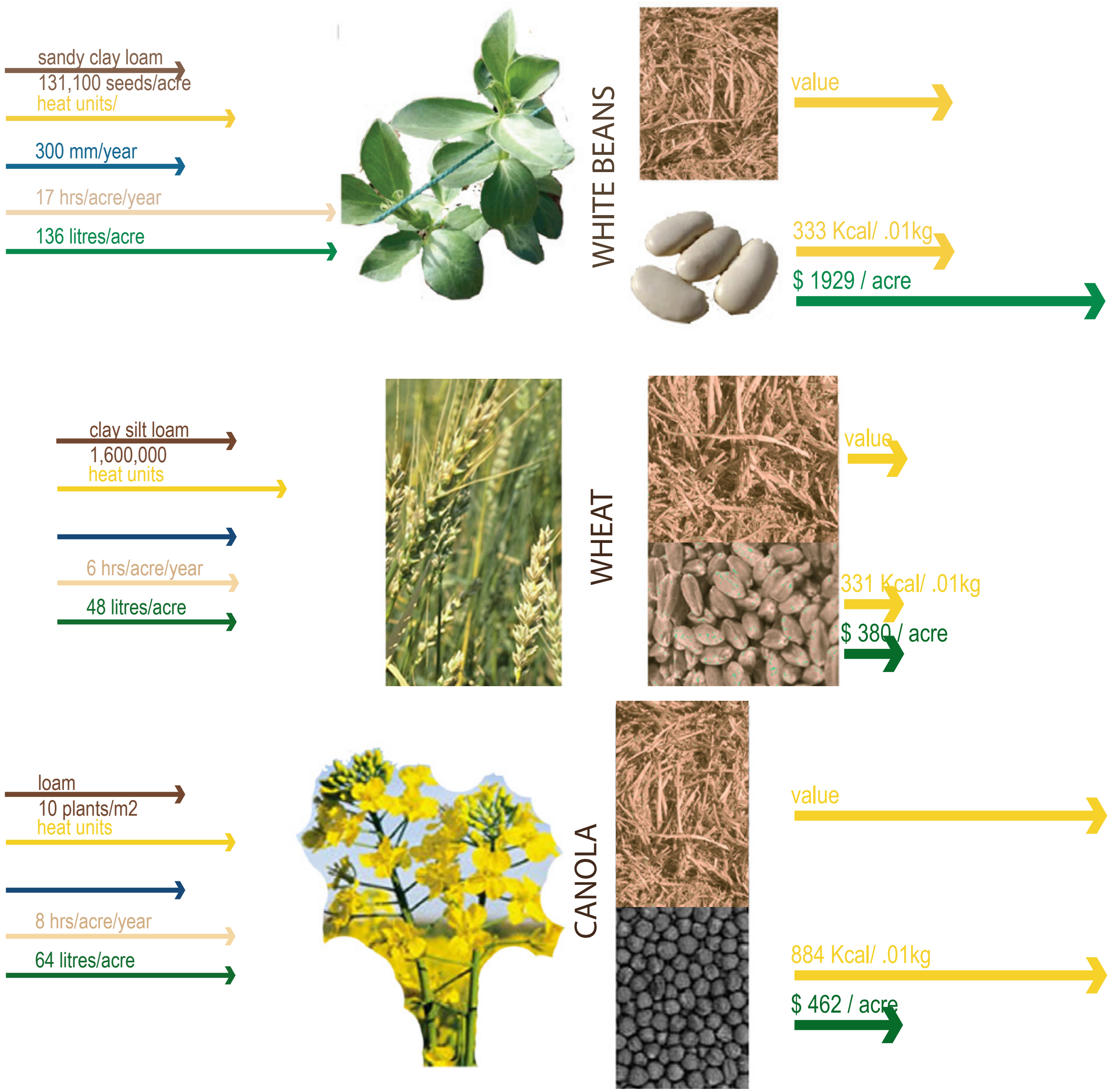


Fig8.51; Corn is the second most efficient crop for calorie gain. Protein gain is the smallest. Corn is the second highest in incoming money. Corn produces a large amount of green waste. Some is fed to animals, but most is left on the field as compost.

Fig8.52; Soybeans are the third most efficient crop. Soybeans also have the third highest protein content. Soybeans produce a large amount of green waste. Usually this waste is used for bedding animals, however it could be used as insulation, green fertilizer, or burning fuel.

Fig8.53; remaining crop analysis




sandy clay loam
131,100 seeds/acre
heat units/
300 mm/year
17 hrs/acre/year
136 litres/acre
WHITE BEANS
value
333 Kcal/ .01kg
$ 1929 / acre
clay silt loam
1,600,000
heat units
6 hrs/acre/year
48 litres/acre
WHEAT
value
331 Kcal/ .01kg
$ 380 / acre
loam
10 plants/m2
heat units
8 hrs/acre/year
64 litres/acre
CANOLA
value
884 Kcal/ .01kg
$ 462 / acre

Existing Attractors

Abiotic conditions determine where there are farming communities. Ideal soil, water, sun, and wind conditions exist for every type of farming. These factors affect the design decisions.

Economics are mainly controlled by the marketing boards and government programs. Currently the government programs support environmental farm upgrades, and insurance for poor crop years. Income levels and amount of work required is a key deterrent for next generation farmers. All farmers must be businessmen in contemporary farming to keep profit margins high.

Social communities are declining with decreasing farm populations. The next generation sees the excitement, culture, and ease of the city as greener than the rural community life.

The information age has brought a whole new level of knowledge to farmers. Television and internet are now part of the farmer's everyday activities and global community. This information can influence schedules with weather forecasts, can increase production through knowledge gain, entice immigration to urban centers, provide entertainment.

Architectural identity does not exist. Farm architecture has degraded to cheep materials and uniformity of types. Farms have lost dignity in architecture and identity in each farm. Contemporary farming is no longer the grand working estate nor the proud yeoman farm.

Energy flows through the farm are being utilized more efficiently to reduce production costs and increase profits. These flows can assist in creating sustainable farming practices.

Goals

To reduce the decline of the farming community farming must be made attractive for next generation farmers. It must be more economically viable through government programs and support. The goals of the Sustainable Progressive Farmstead are

...to design an energy, economically, and generationally sustainable farm

...to design a new identity for the sustainable progressive farmstead with dignity and pride

...eventually to design a farm community with strong ties and culture

Actors

Ministry of Agriculture
- provides information and programs for the farming community

Marketing Boards
- some marketing boards make it illegal to sell products outside of the board
- Marketing has increasingly taken a larger share in the available income for farmers
- marketing boards need to work FOR the farmers not against them

Farmers
- need to be willing to change attitudes towards shared facilities
- Farming culture need to find value in designing entire systems for function, quality, and beauty

Social groups
- these groups are generally very active in the communities for youths, woman, and families

Co-operative sector
- for assistance in co-operative start-ups among farming communities

Architects
- need to promote themselves as designers for systems, lifestyle, efficiency, sustainability, overall understanding of a farm unit

Strategic Initiatives

Sustainable Farming

This means sustainable in three categories, economics, sustainability, and generations.

Economics cannot be controlled by architecture aside from savings through efficient building systems. Government programs and incentives need to really encourage farming stability.

There are many processes, systems, and energy flows through a farm unit. These energies are exploited for all the potential and waste energies. For example Methane can be harvested for electricity and the processed manure can be used as fertilizer.

Finally, generationally the farm needs to be appealing for the next generation. This can be achieved through attractive building and landscape, community amenities, lifestyle, and exciting and innovative potential of a farming career.

Aesthetics

There has been a particular identity for each phase of farming, non-mechanized and mechanization age. The new phase in the information age requires an identity. This identity can be created by deliberate architectural design that has not been present in the past vernacular styles. Sustainability will be a major part of this identity.

Community

Community has always been a very strong part of the rural community. As this community gets smaller there will be a need to facilitate and design this community. This may be designed through changing the concession system or shared resources.

Management

The health of the rural community needs to be monitored so that appropriate programs and solutions can be formed.
Health can be measured by,
Size of farms

- Amount of rented land, vs. owned land
- Change in number of farm operators
- Amount of farmers who have other sources of income (Statistics Canada 1994)
- Farmers' satisfaction with farming (Sontag and Bubolz 1996, 169, 174)
- Amount of energy being used in the agriculture sector (Statistics Canada 1994)

Value of farm assets and building (Statistics Canada 1994)

Conclusion

Changes in farming practices are going to take place as technology improves, populations change, and sustainability becomes a major issue in all aspects of the world. Farming provides food for the world and it must change and adapt or the world will starve. This report clearly states that the current state of farming is not in its ideal shape. Communities have changed dramatically over the years, energy usages have increased over the century, and income for farmers has decreased over the past 50 years. These issues and others need to be addressed by the rural community to find a more suitable model to create a sustainable farm.

Among the major changes of the 20th century was the mechanization of farming. Tractors on Canadian farms increased from 159752 to 549289 from 1941 to 1961 In the 21st century sustainable farming will be the new era (Tremblay and Andderson 1966, 183) The amount of farms which are net zero energy will increase. The number of farms which use environmentally sustainable practices like crop rotation and no till has already increased from the 1970s. These numbers and other practices will continue to grow. However it must by educated growth and address the energy problems at the roots not apply 'band-aid' solutions like wind turbines to make more electricity for an already inefficient farm operation. Architects have a unique perspective in this realm as we are taught to think about energy and sustainability at the root, in the daily operation of a building or design.

Architects understand the need for shelter and practical needs of a building. They also understand beauty. Therefore there is a role for architects in farm design. Architects are able to understand the building in its totality. Architects design a building from structure, heating, lighting, and skin, to beauty, flow, function, and landscape. This report describes many of the factors needed to make good decisions about a farm design. It gives an architect the tools needed to design a sustainable farm operation. Sustainable design will include not only energy, but also generationally, economically, socially, and architecturally.

Fig8.54; A field in Middlesex County
Fig8.55; A dairy farm in Middlesex County

Viewshed Study

Defining a Cultural Landscape: Middlesex County Analysis
The goal of this essay is to present different perceptions of landscape and apply them to a sample area in Middlesex County and define what that landscape values are, and hint as to how to design in this context.

Part One – Perceptions of Landscape
"…People have experiences, develop beliefs and attitudes, form value patterns and evolve ideologies, all of which reflect their particular environment." (Tremblay and Anderson 1966, 228). These ideals, beliefs and attitudes are then reflected back by the environment. Thus a culture can be defined by the landscape and a landscape can be defined by the culture. Although people develop in the same environment they experience their landscape differently and value different thing in the landscape. All these perceptions of the landscape make designing in it difficult. This is a fundamental issue in viewshed planning. How can the perfect landscape be created for every inhabitant of the area? This study is an attempt to find common characteristics in a rural landscape which are valuable to a particular culture and then apply them to a landscape to develop a picture of a culture in Middlesex County.

Rural Landscapes are particular and different from urban or natural landscapes. These landscapes have their own rules and values. John B. Jackson describes, in "The Historic American Landscape", the Connecticut River Valley which was cultivated into farmland from beautiful meadows. This landscape "became something more than a topographic concept. It became a landscape, perhaps the most extensive and certainly the most clearly defined human landscape in New England" (Zube, Jackson 1975, 5). This landscape although modified by man was still describes as
beautiful. In describing rural landscapes one cannot use the terms man-made and natural (Smardon, Schauman 1986, 106). The rural

Landscape is a hybrid of these two terms. Is a cultivated field of corn natural or man-made? The entire rural landscape is modified by man.

There seems to be two conflicting views of a beautiful landscape. The conflict exists between religious landscapes and engineered landscapes. The first landscape is "beautiful when it revealed a moral or ethical truth" (Zube, Jackson 1975, 1). This view is often associated with a farm lifestyle with a church in the landscape. It still holds true in many farmers view of their land. They are responsible for the care and protection of the soil, forests, and animals. However, through the past century a second view of the rural landscape has emerged through engineering feats and emigration to urban centers.

> The old covenant [has] been broken or annulled; there [are] no longer any agrarian routines and duties to teach citizenship and piety; without attachment to some piece of land, men lost their visibility. (Zube, Jackson 1975, 8).

The engineered landscape is often seen as insidious. It is manifested in bridges, roads, railroads, coal mines, dams, oil wells, hydro lines, and aggregate extraction. "Beauty in the landscape was redefined in terms of efficiency in the flow of energy within the system" (Zube, Jackson 1975, 1).

From these two landscape views two modes of action can occur. One is a rejection of engineering and another is the acceptance and readiness to take part. These two actions form our relationship with landscape (Zube, Jackson 1975, 8). In the rural landscape context the first is a more common reaction in viewing landscape, but the second is put into practice. "The countryside conjures nostalgic rather than real interpretations" (Smardon, Schauman, 1986, 105). In rural landscapes Schauman argues that the symbolic meanings are more important than the actual physical realities of the landscape (Smardon, Schauman 1986, 105). The agricultural landscape is a desired place to live, although it is not currently display the physical characteristics that are associated with the nostalgic desire.

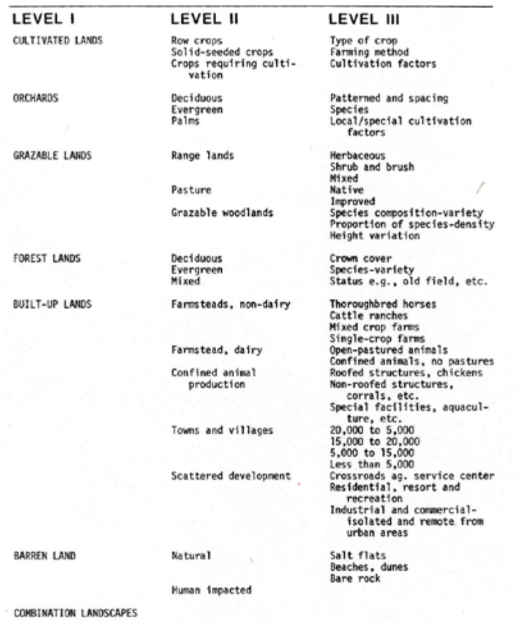
Three stereotypical views of the rural landscape are envisioned by Schauman; agrarianism, ruralism, and pastoralism. These can correspond to those who live in the rural landscapes and how they want the symbolic landscape to look; farmers, ex-urbanites, and cottagers. The first agrarianism, "see the landscape as sanctified because farming is a noble endeavor basic to all economic pursuits" (Smardon, Schauman 1986, 105). This view is similar to Jackson's religious view of landscapes. The farmers are proud, self-sufficient, and can take this view to the extreme as factory farm have. The second view is ruralism and is associated with the rural resident who does not farm, but lives in the countryside. These residents are against anything urban and are looking for a back-to-the-basics type of living (Smardon, Schauman 1986, 106). This population often conflicts with the agrarianism as they are unclear as to what this anti-urban living is, but it is not what they experience currently. The third view is a pastoral vision of the rural landscape. These people who move to the country are looking for beauty and tranquility. They do not tolerate visual change which threatens these two qualities (Smardon, Schauman 1986, 106). These people value the scene of the countryside but do not actually use it.

Schauman's landscape views are very symbolic; these views value a form which may not actually exist in reality, yet still hold extreme value to the culture. These three views are extremely nostalgic. Jackson's views are descriptive of how the rural landscape has changed physically and the conflict between the nostalgic views of the religious landscape and the invasive view of the engineered landscape. The current rural landscapes are defined by more and more engineered buildings. The nostalgic view is disappearing. It is felt by culture that the new engineered landscape lacks the symbolic values of farming.

Part Two - Precedents

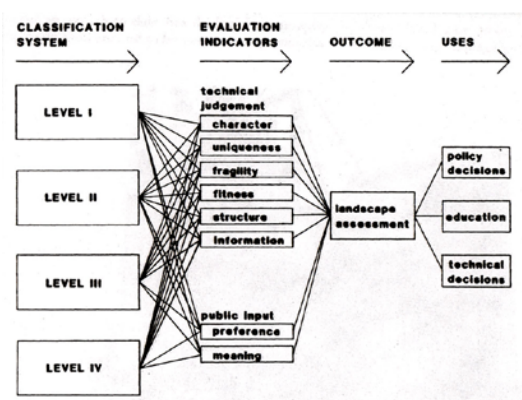
With these different perspectives on rural landscape many different factors can make a landscape beautiful. Jackson presents two reactions to changes in the rural landscape. One is to reject the engineered landscape and preserve the historic landscape. This view is no longer economically viable, nor possible, as cultural landscapes, like nature evolve. The second reaction is to accept the engineered solutions and to accept the pressures of a global world. However, "we know people like to look at wooden barns and quaint farmsteads. Do the structures of modern farm technology evoke similar pleasant reactions" (Smardon, Schauman 1986, 108)? This solution is also not ideal as there is a loss of culture. The symbolism of Schauman's landscapes must be combined with the reality of the engineered landscape.

The following examples are precedents for rural landscape assessments. They describe characteristics and methodology of assessing a rural landscape.



LEVEL I	LEVEL II	LEVEL III
CULTIVATED LANDS	Row crops Solid-seeded crops Crops requiring cultivation	Type of crop Farming method Cultivation factors
ORCHARDS	Deciduous Evergreen Palms	Patterned and spacing Species Local/special cultivation factors
GRAZABLE LANDS	Range lands	Herbaceous Shrub and brush Mixed
	Pasture	Native Improved
	Grazable woodlands	Species composition-variety Proportion of species-density Height variation
FOREST LANDS	Deciduous Evergreen Mixed	Crown cover Species-variety Status e.g., old field, etc.
BUILT-UP LANDS	Farmsteads, non-dairy	Thoroughbred horses Cattle ranches Mixed crop farms Single-crop farms
	Farmstead, dairy	Open-pastured animals Confined animals, no pastures
	Confined animal production	Roofed structures, chickens Non-roofed structures, corrals, etc. Special facilities, aquaculture, etc.
	Towns and villages	20,000 to 5,000 15,000 to 20,000 5,000 to 15,000 Less than 5,000
	Scattered development	Crossroads ag. service center Residential, resort and recreation Industrial and commercial-isolated and remote from urban areas
BARREN LAND	Natural	Salt flats Beaches, dunes Bare rock
	Human impacted	
COMBINATION LANDSCAPES		

Fig8.56; Countryside Classification System
Fig8.57; Countryside Assessment System



Countryside Landscape Visual Assessment

Sally Schauman outlines characteristics that are important in the symbolic rural landscape.
Topography – less important in the countryside as it is often flat
-slight topographic changes are exaggerated by linear crop plantings and fence lines.
Vegetation – this includes crops, tree lines, woodlots, pastures, orchards
-they provide a visual focus and act as screens
Water – this is the most preferred type of landscape (Zube 1975, 154)
-irrigation, ponds could be as preferred, but there has not been study done in agricultural water
Sky – expansive sky without air pollution, or light pollution is a special characteristic of rural landscapes
Human and animal Activity – cows grazing, plowing the land, spreading manure
Land Use – as an indicator of meaning
- elements which modify our perception of landscape.

Schauman's assessment is good at converting symbolic meaning into physical characteristics. The actual rating of these physical elements does not come out in her article. Nor does she take a stand on how to deal with modern farm elements in the landscape. When basic principles are applied like visible human and animal activity it makes more meaningful
landscapes.

The Farm Landscape of Whatcom County; Managing Change through Design

The University of Washington, Department of Landscape Architecture put together a photo catalogue of Whatcom County farm landscape. In this catalogue they address the growing concern of modern barns invading the rural landscape. She photographs all the elements which make up a farm.

She then addresses landscape strategies for site planning and maintaining building appearance. For example, bunker silos which are roofed should blend with other roofs on the site, roofless bunkers should be hidden from view as they look unfinished (Whatcom 1985, 20). Cow yards should be on well drained soil and have maintained fences to block the trampled earth (Whatcom 1985, 21). This brief catalogue does not shy away from the modern barns, but critiques them to provide ideas for maintaining the symbolic view of the rural landscape.

Minnesota Historical Assessment (Mead & Hunt, Inc)

This study was used to determine if there was a heritage landscape in Minnesota that could be preserved under the heritage act. The goals of this study were slightly different from my study as the issue of modern development is avoided.

These are the characteristics that were used to rate each property;

- Overall patterns of landscape spatial organization
- Land use: categories and activities
- Response to natural features
- Circulation networks
- Boundary demarcations
- Vegetation related to land use
- Cluster arrangement
- Structure: type function, materials, construction
- Small-scale elements
- Historical views
- Circulation networks
- Cultural traditions
- Archeological sites

Each individual property was documented with the following information

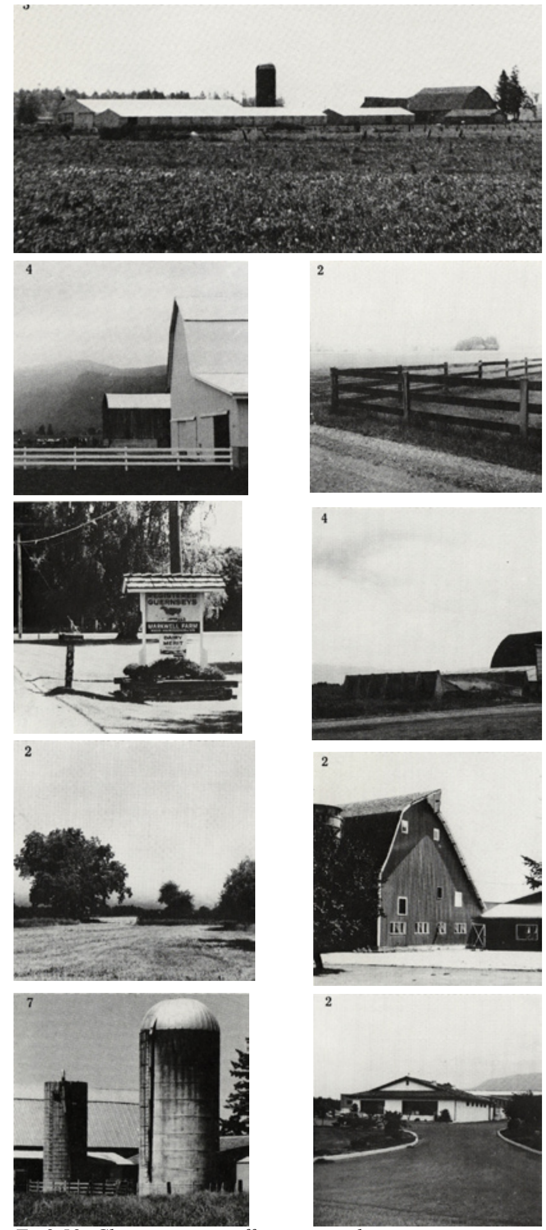


Fig8.58; Characteristics affecting visual impact.

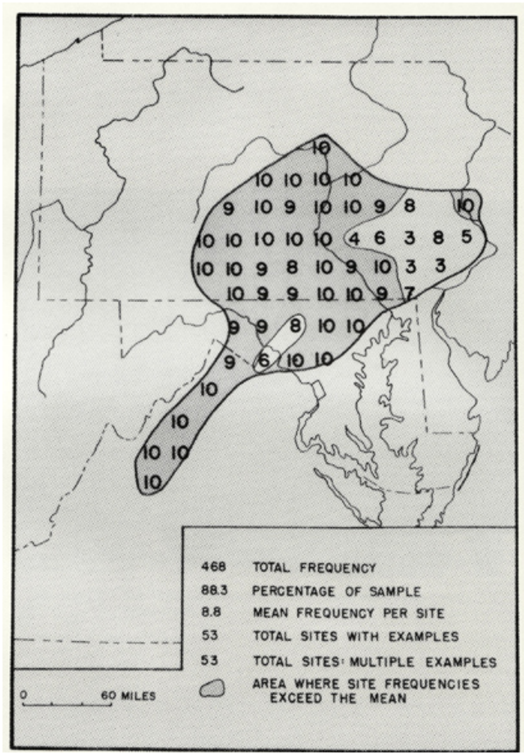


Fig8.59; Barn Sample Area
Fig8.60; A Pennsylvania Barn

Locational information
Basic descriptive information
Property type
Related historic context
Resource count of buildings, sites, structures, and objects
Description of land uses
Identification of boundary demarcations
Vegetation related to land use

Because this study was a historic study the following definition was used for a historic landscape; “a geographic area which has undergone past modification by human design or use in an identifiable pattern, or is the unaltered site of a significant event, or is a natural landscape with important traditional cultural values.” This definition according to the NRHP adds these qualities to the list of evaluation criteria; design, historic events, and visual character and intangible qualities. The first and the last can be added for my evaluation to add a dimension to the study which starts to get at the culture of the study area.

Pennsylvania Culture Region
This study was an independent research project by Joseph W. Glass. He approached his study “from the barn.” He began with a barn type typical to the first settlers of the region and attempted, through the typical barn construction and the variations, to delineate a boundary and get insight into the particular culture of this region.

> “The people who built and used Pennsylvania barns on their farm were the same people who developed the Pennsylvania Culture and lived its lifestyles. These people have been gone for many generations […] their barns, however, remain. Erected to shelter animals, crops, tools, and some farming tasks, they were not intended to convey thoughts. But they do” (Glass 1971, 21).

Glass defined a boundary based on historical settlement and patterns. From here he laid a grid of properties which would be his sample of the Pennsylvania Culture region. The following were the characteristics evaluated in the research:

Barns
- With or without forebay
- Forebay styles
- Bank or no bank
- Shape
- Machine shed attached to the barn
- Originally in an ‘L’ shape
- Roof style
- Building materials
- Siding alignment
- Colour
- Billboard barns
- Common signs
- Orientation
- Barn and road relationship
- Topography

Farmhouse
- Height and facade
- Openings in front
- Roof type
- Shape of house
- Chimneys
- Front porches
- Balconies
- Construction materials
- Colour
- Orientation

Additional
- Relationship between house and barn (Ridge lines)
- Additional Thoughts and characteristics I would add
- Tree cover
- Mailboxes
- Modern farmhouses
- Ex-urbanite house

Glass also did an extensive context study of the site, including historical context and evolution of the area. Glass mapped each characteristic to try and define where the boundaries were and if particular characteristics were scattered or clustered. Each characteristic defined a story behinds its formation.

Visual Assessment of the Greenbelt

The fourth precedent study is a typical viewshed study of the Greenbelt done in 1992. The goal of the study was to determine how the greenbelt is perceived by visitors and users of the sites. Particular views were determined for the visual assessment. Their classification system "is descriptive, not evaluative" (Greenbelt 1992, 12). Using public participation they determined what the preferred landscape features were. These features were "natural areas for wetlands and wildlife; agriculture and forest lands; and nature-oriented parks and passive recreation opportunities" (Greenbelt 1992, 18). The public also used the word beautiful and green when describing their preferred landscape features (Greenbelt 1992, 18). The least preferred landscapes were transportation corridors; facility-oriented recreation activities; community institutions such as churches or schools and; sites for government agencies, housing and/or commercial development (Greenbelt 1992, 18). From this an evaluation sheet was made to determine the quality of the existing landscapes. The following four points are exhibited in a preferred landscape.

1. The landscape is perceived as coherent and unified with all its elements and patterns contributing to a compositional harmony.
2. The landscape is perceived as having some defined special qualities as defined by landform and vegetation which results in both open and closed spaces that offer long, short, and blocked views.
3. The landscape provides the viewer with a moderate amount of information or variety so as to not be either too chaotic or too boring.
4. The landscape provides quality long or short views to adjacent landscapes.

(Greenbelt 1992, 23)

Four primary indicators are created from this, unity/harmony, variety/complexity, structure/views, and maintenance/health. Thre secondary indicators follow on the evaluation form; Adjacent Scenery, cultural modifications, and meaning. (Greenbelt 1992, 24) Beside each point comments are made, some are helpful and specific others, like "meaning" are not.

From this study I take these qualifications to determine an overall rating for each property. Beside each property I make my notes which are more descriptive and specific than the notes used in this study which don't help the evaluation process.

Part Three – Analysis

By looking at the previous examples two trends emerged. One is a physical analysis of the characteristics of the place. The second is a documentation of the physical traits to determine a vernacular style and cultural patterns. Using the extensive list of characteristics I condensed it to make my own list of important traits in order to determine if any were more preferable and find trends in the study area.

Farm
-chicken
-horse
-beef
-dairy
-grain
-other
Typical Icons -silo
-fence
-barn
-house
Barn Construction-Materials-stone
-concrete
-wood
-steel
-openings (were contents visible or a completely sealed barn)
-colour -red
-green
-yellow
-white
-brown
-blue
-steel
-orange
-signage (on the barn or at the road)
-new or traditional type-total on farm
-number that were new construction
-number that were traditional
-roof type-pitch
-gamble
-flat
-round
Site Planning (arrangement of buildings on the site and their relationship to each other)
-distant (did the barns an house seem like separate entities)
-whole (did the house and barns operate as one property)
-measure (what was the distance between the house and the barn)
House
House Construction-Cladding Materials-brick
-stone
-wood siding
-vinyl siding
-Colour -red
-blue
-yellow
-white
-brown
-roof -pitch
-gamble
-hip
-flat
-dormers
Height -one storey
-two stories
Porch

Garage
Land Use (was activity visible on the site, does not include cropland over the countryside)
-kids area
-tractors
-animals
-orchard or crop
Vegetation-hedge rows (tree lines along fences or property lines)
-general planting (there were trees and bushes around)
-'finished' planting (formal landscaped style, smaller in scale closely around house)
-water or other feature (this included a bush, stream, orchard, decorative gardens, etc)
-private wall (did the planting hide the property and make it seem like a private property)
-accent planting (did the vegetation accent and not hide the house)
Community-what was the distance from the road to the house
Comments (I made notes on how I felt about the property)

The second trend was a more intangible and subjective assessment of the study area. The meaning, quality of the view, unity, heath of the view, are a matter of opinion. I assessed the property in six categories;
Placeness (does the property respond to the site, does it belong there)
Unity and Composition (is the site layout appealing to the eye, this often can change depending on the angle of the photograph)
Health (are the buildings looked after, this condition resulted after many old farm sites no longer being farmed have allowed the barns to fall into disarray)
Variety and Complexity (this was based on how many buildings on the property and how complicated the programming was, farming almost always scored 4 and house lots almost always scored 1)
Welcoming (was the house approachable, did it feel comfortable?)
Attractive (did the site or architecture generally feel attractive)
The Overall rating was an addition of all of the above conditions except Complexity as I felt that it would skew the results in a certain direction

Each property was assessed and each road was totaled. From there I made a summary of all the properties, just the farm properties, and just the house properties. See appendix B for the Bear Creek

Fig8.61; Sample area around Ilderton in Middlesex County.

Fig8.62; The following two houses were the highest rated in the study area:

Hyde Park Road property #3, rated 18/20

Placeness: 3 Unity/Composition: 4

Health: 4 Variety/ Complexity: 4

Welcoming: 3 Attractive: 4

-red is a very dramatic colour in the snow and the green summer landscape

-the yard is open and framed by the house and the barn

-the fence links a small barn in the back to the entire property

-the barns roofs should be the same colour

Tenth Concession property #7, rated 18/20

Placeness: 4 Unity/Composition: 4

Health: 3 Variety/ Complexity: 4

Welcoming: 3 Attractive: 4

-the blue house is comforting and cozy

-the fence is a unifying element

-the open shed at the back is nice to see wagons

-trees may be a bit too dense

Part Four - Results

Context and General Trends

The Results prove interesting. General trends emerged with the architecture and start to give a general context for the site. A manageable area was chosen in Middlesex county containing 100 properties (see previous page for site map). The site falls in two historic townships; London and Lobo. Both of these townships were surveyed with 100 acre lots. London township and Lobo Township opened in 1812. The site boundary was made by concession 10 and Concession 12 on the north and the south, and Hyde Park road, and Bear Creek road on the east and west. The city of Ilderton is on the east edge of the site. Historically it has been a small town; however it has experienced recent explosive growth due to its proximity to London. Thus the ratio of agricultural properties to non agricultural properties is 37 to 63. Of the farms there is a fairly even spread of types, over chicken, dairy, beef, grain, horse, and other. The farms averaged about a 2:1 ratio of new buildings to old buildings. Half of all the houses in the area are new and half are original farm houses. 57% of these houses were brick and 32% were vinyl siding. White was a popular colour for both barns and houses, 20.5% of the barns were white and 36.5% of the houses were white. When brick was chosen as a house cladding material yellow was the farmhouse colour and red was the ex-urbanite colour. This suggests that yellow is the type of stone available in the area, however red must be a more popular colour in terms of image and visual affect. The roof type is generally a pitch roof with some hip roofs. Vegetation in relationship to the properties usually fell into a general planting category; only 50% of the properties had significant hedge row, and property line plantings typical of rural landscapes. This could be due to the fact that many farms have been amalgamated or farmers have taken old trees down to increase workable land. Many of the new ex-urbanite developments still have new small trees only.

Ratings in Relationship to Characteristics (What is a desirable rural property?)

The rating system was based on place, unity and composition, health, welcoming, and attractiveness. Overall the area has an 11.06 rating out of 20. (I must be very displeased with the area or a very harsh marker). The agricultural properties had a slightly higher rating of 12.17 than the average. The agricultural properties scored higher in the general attractiveness and the composition categories. See appendix A for the isolated characteristics and their ratings.

The closer the house to the road the higher the rating probably because these houses I felt were more approachable and they seemed to be ‘involved in the community. The two storey houses rated higher then the one storey houses. The number of two storey houses is almost equal to the number of one storey houses; however the two storey house was often an original farmhouse thus it generally rated higher. Of all the houses the brick ones rated higher than sided houses. Many of the original farmhouses have been reclad with vinyl siding, white being the most popular colour. I don’t understand the choice of white in this setting as red and yellow brick are traditional rural colours and are evenly chosen on the brick houses. This is a possible indication of the economic decline of the area.

The major aesthetic difference between the traditional barn and the modern barn is size and the cladding. I will negate that the size affects the rating as most of these farms had a combination of old and new barns, thus leaving a distinction between the wood clad barns and the steel clad barns. Surprisingly the steel clad barns rated 11.56 and the wood barns rated 9.74. This shows that there are factors, other than the typical wood bank barn, which determine the visual preference of rural landscapes. Perhaps the issue culture has with the modern barns is a moral one which is trying to resist the technological changes taking over farming.

More extensive review of the results could be done in further studies to find more trends.

Fig8.63; The following were the two lowest rated properties in the study area:

Venneck Road property #9, rated 7/20

Placeness: 1 Unity/Composition: 2

Health: 2 Variety/ Complexity: 1

Welcoming: 1 attractive: 1

-barn is being ignored

-why choose white siding

-trees are hiding the barn and don’t connect it to the house

-very stark yard

Health: 3 Variety/ Complexity: 4

Welcoming: 1 Attractive: 1

-the second long barn is being hidden by the front one, this is both good and bad

-house is hidden and only the garage can be seen

-white is a drastic colour against the bush line

-the barns are blocking all views to the property

-composition of property is not very appealing

Part 5 - Conclusions

Going through each property and writing my comments I came across some general strategies that were used on the properties that had meaning. The following strategies can be applied to new designs.

-Trees covering and hiding the property was not appealing. General planting with views to the larger landscape were desired. A tree lined laneway leading to the house or a barn was very comforting and added to the composition of the property.
-Fences were a nice feature on properties and unified the layouts.
-sites where activity and land use were visable show signs of life and care
-a property where views were left open to the landscape beyond we far more powerful than properties which did not
-The varied roof lines of this house made me realize that that is a typical quality of rural properties. As they grow and evolve, each new building is not quite the same as the previous because of different need requirements.
-The very frontal facades of many of the new suburban houses are harsh in a rural landscape. The compact, tall farmhouses do not suggest a backyard and affront yard, but embrace all
sides of the landscape.
-Many properties have a shed for some purpose, but there is no relationship between the house and the shed. They are too far apart, they are of different architecture, and they cannot be understood for their purpose like an agricultural property understands barns and pastures.

Each property has a story behind it. Even the properties where the farm is ruined and the one that the farmhouse has recently been torn down, but the trees and a small pile of rubble hint at its history. There are so many stories about different people, different places, and different times. Together these stories form a cultural landscape. This area of Middlesex County is a weave of old and modern farms in a balancing act with exurbanite residents. There seems to be an image of a rural landscape which is forgotten by all residents. New construction and forgotten barns do not build on the principles of the past landscape. There are still hints of this landscape hidden under white vinyl cladding or green corrugated steel. Jackson's engineered landscape has taken over and left the symbolic landscape behind. The landscape described by Schauman's pastorialism has not been defined by the new houses. These houses do not make a statement about living in a rural landscape. They are only suburban houses displaced into a rural landscape. This landscape in Middlesex County seems to be a forgotten landscape.

Fig8.64; Abandoned farm property in Middlesex County.

	Farm	House	Farm Type						Typical Figures				Barn Construction																					House Construction			
			chicken	horse	beef	dairy	grain	other	silo	fence	farmhouse	barn	stone	concrete	wood	steel	openings	red	green	yellow	white	brown	blue	steel	orange	signage	# total	# new	# old	pitch roof	gambrel roof	flat roof	round roof	brick	stone	wood siding	vinyl siding
OVERALL SUMMARY																																					
Line 12	11.5	8.5	2	2	5	0	1	1	7	2	18	13	2	10	2	12	2	0	1	3	7	1	4	1	1	1	59	42.5	16.5	11	2	0	2	9	1	4	6
Ilderton Road	5	16	1	2	1	0	1	0	3	2	5	4	0	4	1	4	0	0	1	0	3	1	0	0	0	0	24	16	8	4	0	0	0	12	1	2	7
Hyde Park Road	2	1	0	0	0	1	0	0	2	1	2	3	1	1	0	3	0	1	0	0	2	0	1	0	0	0	11	3	8	2	2	0	2	2	0	0	0
Denfield Raod	3	4	2	0	0	1	0	0	2	1	2	4	1	3	1	5	0	0	1	0	4	1	1	0	0	0	10	4	6	4	1	0	1	5.5	1	0	0.5
Venneck Raod	4	8	0	1	0	1	0	1	2	2	3	4	0	4	2	2	0	1	0	0	1	2	0	0	0	2	6	2	4	3	1	0	0	7.5	0	0	3.5
Bear Creek Road	3	4	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	3.5	0	0	3.5
New Ontario Road	1	1	0	1	0	0	0	0	0	1	2	1	0	1	0	2	0	1	0	0	0	1	0	0	0	0	3	3	0	2	0	0	0	2	0	0	0
Ivan Road	4.5	6.5	0	0	1	1	1	1	1	3	4	4	0	5	3	2	0	1	0	1	0	3	0	0	0	0	11	7	4	5	0	0	0	7.5	0	0	3.5
Line 10	8	10	0	1	0	1	3	1	3	2	6	6	0	10	3.5	6.5	1	2	1	0	2.5	3	1	1	0	1	29	20	9	8	2	0	1	9	1	0	8
TOTALS	**42**	**59**	**6**	**7**	**7**	**5**	**7**	**4**	**21**	**14**	**44**	**41**	**4**	**40**	**13.5**	**37.5**	**3**	**6**	**4**	**4**	**20.5**	**13**	**7**	**2**	**1**	**4**	**158**	**101**	**57.5**	**41**	**8**	**0**	**6**	**58**	**4**	**6**	**32**
FARM SUMMARY																																					
Line 12	10	0	2	2	5	0	2	0	7	2	9	10	0	9	1	9	3	1	1	2	4	0	3	1	1	0	52	42	10	9	1	0	1	6	0	0	3
Ilderton Road	5	0	1	2	1	0	1	0	3	2	5	4	0	4	1	4	0	0	1	0	3	1	0	0	0	0	24	16	8	4	0	0	0	4	0	0	1
Hyde Park Road	1	0	0	0	0	1	0	0	1	1	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	5	2	3	1	1	0	1	1	0	0	0
Denfield Raod	3	0	2	0	0	1	0	0	2	1	2	3	0	3	1	3	0	0	1	0	2	1	1	0	0	0	6	2	4	3	1	0	0	2	0	0	0
Venneck Raod	3.5	0.5	0	1	0	1	0	1	2	2	3	4	0	4	2	2	0	1	0	0	1	2	0	0	0	2	6	2	4	3	1	0	0	2	0	0	1
Bear Creek Road	3	0	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	1.5	0	0	1.5
New Ontario Road	1	0	0	1	0	0	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0
Ivan Road	4	0	0	0	1	1	1	1	1	3	4	4	0	4	2	2	0	1	0	1	0	2	0	0	0	0	10	7	3	4	0	0	0	3	0	0	1
Line 10	6	0	0	1	0	1	3	1	3	2	6	6	0	6	2.5	3.5	1	1	1	0	2.5	1	1	0	0	1	22	15	7	5	1	0	0	2	0	0	4
TOTALS	**36.5**	**0.5**	**6**	**7**	**7**	**5**	**8**	**3**	**20**	**14**	**33**	**35**	**0**	**34**	**10.5**	**26.5**	**4**	**5**	**4**	**3**	**13.5**	**9**	**5**	**1**	**1**	**3**	**131**	**90**	**41**	**32**	**5**	**0**	**2**	**22.5**	**0**	**0**	**12**
RESIDENTIAL SUMMARY																																					
Line 12	0	8	0	0	0	0	0	1	0	0	9	3	2	0	0	3	0	0	0	0	3	0	1	0	0	1	7	1.5	5.5	2	1	0	1	3	1	4	3
Ilderton Road	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1	2	6
Hyde Park Road	0	1	0	0	0	0	0	0	1	0	1	2	1	0	0	2	0	0	0	0	2	0	1	0	0	0	6	1	5	1	1	0	1	1	0	0	0
Denfield Raod	0	4	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	2	0	0	0	0	0	4	2	2	1	0	0	1	3.5	1	0	0.5
Venneck Raod	0	7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.5	0	0	2.5
Bear Creek Road	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
New Ontario Road	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	2	0	1	0	0	0	1	0	0	0
Ivan Road	0	6.5	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	4.5	0	0	2.5
Line 10	0	10	0	0	0	0	0	0	0	0	0	0	0	4	1	3	0	1	0	0	0	2	0	1	0	0	7	5	2	3	1	0	1	7	1	0	4
TOTALS	**0**	**58**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**11**	**6**	**4**	**5**	**2**	**11**	**0**	**2**	**0**	**0**	**7**	**3**	**2**	**1**	**0**	**1**	**27**	**11.5**	**15.5**	**9**	**3**	**0**	**4**	**35.5**	**4**	**6**	**21**
ORIGINAL FARMHOUSE	27	22	3	3	6	5	5	1	16	10	29	26	2	25	9.5	21.5	2	4	3	3	10.5	7	6	0	1	2	97	56.5	40.5	26	4	0	3	29	1	2	18
NEW RESIDENTIAL	12.5	36.5	2	4	0	0	2	2	5	4	16	12	2	12	3	15	1	3	0	1	8	5	0	1	0	1	37	22	15	12	3	0	3	30	3	4	14
< 100 ft from road	29.5	52.5	4	6	4	3	5	3	13	10	32	28	4	26	9	28	3	5	1	2	16	11	4	2	1	3	119	74.5	44.5	29	7	0	6	50	3	6	23
> 100ft from raod	12.5	5.5	2	1	3	2	2	1	8	3	12	13	0	13	4.5	9.5	0	2	3	2	3.5	2	3	0	0	1	40	25	15	12	1	0	0	8	1	0	8
LAND USE VISABLE	21	7	0	5	2	4	3	3	9	12	20	20	0	19	6.5	17.5	2	5	0	3	7	8	4	0	1	3	58	29	29	20	7	0	2	17	2	2	5
NOT VISABLE	23	52	6	2	5	1	6	1	14	2	26	23	4	21	7	22	3	3	4	1	13.5	5	3	2	0	1	108	75.5	32.5	23	1	0	4	43	2	4	27
1 storey	6	24	1	2	0	0	2	0	2	2	8	5	0	6	0.5	6.5	1	2	0	0	2	2	0	1	0	0	15	11	4	6	0	0	1	18	0	1	11
2 storey	32.5	33.5	4	5	6	4	5	3	18	11	36	32	4	30	11	30	2	5	3	4	16.5	9	6	0	1	3	115	65.5	49.5	31	7	0	5	40	4	5	20
RED BARN	5.5	2.5	0	1	0	1	2	0	4	2	7	6	0	6	3	6	1	7	0	1	0	1	0	0	0	0	25	14	11	8	1	0	1	7	0	0	1
OTHER COLOUR BARNS	26	7	5	5	2	4	4	3	11	11	24	27	3	27	9.5	25.5	2	0	3	2	18.5	11	4	1	0	3	84	48	36	27	6	0	4	21.5	1	2	7.5
STEEL BARN	31	9	6	6	4	4	6	1	16	11	32	32	4	30	6.5	38.5	3	5	4	4	19.5	6	7	1	1	2	116	73.5	42.5	33	7	0	6	28.5	1	2	8.5
WOOD BARN	12.5	2.5	0	1	3	2	2	2	8	4	11	12	0	15	13.5	4.5	0	2	0	2	2.5	11	2	0	0	1	43	15	28	14	3	0	0	10	0	0	4
BRICK HOUSE	25.5	33.5	5	5	3	3	4	1	12	10	26	24	3	25	7.5	27.5	2	5	2	4	13.5	9	2	1	0	1	92	56	36	25	5	0	6	57	1	1	2
SIDED HOUSE	12.5	20.5	1	1	3	2	3	1	9	3	15	13	1	12	4	9	1	1	1	0	5	3	3	0	1	1	38	22.5	15.5	12	1	0	0	2	0	0	31

Fig8.65; Summary rating chart for each road of the sample area.

																			Land Use				Vegitation						Community		Site Plan		INTAGELBLE S (1-4 rating)						
red	green	yellow	white	brown	pitch roof	gambrel roof	hip roof	flat roof	dormers	1 storey	2 storey	porch	garage	original farmhouse	new house	no house	kids area	tractors	animals	orchard/crop	hedge rows	gerneral planting	finished' planting	water or other feature	private wall	accent property	distance from road (ft)	distant	whole	measure	Placeness	Unity/Composition	Health	Variety/Complexity	welcoming	attractive	OVERALL
2	0	7	9	2	15	0	4	0	11	3	16	8	4	13	6	2	0	2	2	4	9	18	13	2	5	17	76.2	10	6	37.86	2.19	2.43	3	2.6	2	2.24	11.86
7	0	4	7	2	14	0	7	0	11	7	14	10	8	11	10	0	1	0	1	1	12	18	2	5	2	15	67.1	2	5	14.76	2.19	2.05	3.24	1.6	2	2.19	11.67
2	0	0	0	0	2	0	1	0	2	0	2	0	3	1	1	1	0	0	1	1	1	2	0	0	0	2	48.3	1	2	50	2.67	2.67	2.33	3.3	2.33	2.67	12.67
2	0	3	0.5	1.5	4	0	2	0	3	2	4	2	10	2	4	2	0	0	1	1	4	5	1	2	2	4	88.6	3	3	35.71	2.29	2	2.57	2.1	1.57	1.86	10.29
3	0	5	4	0	7	0	4	0	7	3	8	6	9	6	5	1	1	1	2	2	3	10	1	1	2	10	75.8	3	2	28.75	1.92	1.83	3.17	2	2.08	1.83	10.83
2.5	0	1	3.5	0	6	0	1	0	3	3	4	3	7	3	4	0	2	0	0	0	7	6	1	0	1	6	60	2	0	21.43	2.29	2	3	1.9	2	2	11.29
1	0	1	0	0	2	0	0	0	0	1	1	0	4	0	2	0	0	0	1	0	1	1	0	1	0	1	70	0	2	25	2.5	2	3.5	3.5	1	1.5	10.5
3	0	3.5	3.5	1	7	0	4	0	5	3	7	6	6	6	5	0	0	1	2	1	5	10	1	4	1	10	83.2	3	2	29.09	2.27	1.91	2.82	2.4	1.64	2.09	10.73
4	1	4	9	0	13	0	4	0	7	7	11	6	14	7	11	0	3	0	2	1	11	11	4	1	3	14	83.6	4	6	28.61	2.11	2.11	2.83	2.3	1.89	2.06	11
26.5	**1**	**28.5**	**36.5**	**6.5**	**70**	**0**	**27**	**0**	**49**	**29**	**67**	**41**	**65**	**49**	**48**	**6**	**7**	**4**	**12**	**11**	**53**	**81**	**23**	**16**	**16**	**79**	**72.5**	**28**	**28**	**30.13**	**2.27**	**2.11**	**2.94**	**2.4**	**1.83**	**2.05**	**11.2**
1	0	5	3	0	6	0	3	0	5	1	8	3	1.5	7	2	1	0	2	2	0	5	9	8	0	2	9	91.5	6	3	47	2.1	2.4	3.3	3.8	2.3	2.3	12.4
2	0	1	1	1	4	0	1	0	2	1	4	1	0	4	1	0	0	0	1	1	4	5	0	0	0	5	107	1	4	45	2	2.2	3.2	3.4	2	2.2	11.6
1	0	0	0	0	1	0	1	0	1	0	1	0	2	1	0	0	0	0	1	0	1	1	0	0	0	1	40	0	1	50	3	4	4	4	3	4	18
0	0	2	0	0	1	0	1	0	1	1	1	1	3	1	1	2	0	0	1	1	2	2	0	0	1	1	118	1	1	25	2.67	2.33	1.67	2.7	1	2	9.667
0	0	2	1	0	1	0	2	0	3	0	3	2	1	2	1	1	1	1	2	2	1	3	0	1	1	3	110	1	2	60	2.25	2	3	3.5	2.25	2.5	12
0.5	0	1	1.5	0	2	0	1	0	2	0	3	0	1	2	1	0	1	0	0	0	3	3	0	0	1	2	83.3	2	0	50	2.67	2	2.67	3	1.67	2.33	11.33
0	0	1	0	0	1	0	0	0	0	1	0	0	2	0	1	0	0	0	1	0	0	0	0	1	0	0	40	0	1	40	3	3	4	3	1	2	13
0.5	0	2.5	1	0	1	0	3	0	1	1	3	0	0	3	1	0	0	1	2	1	1	4	0	2	0	4	111	2	2	61.25	2.25	1.5	2.75	4	1.75	2.25	10.5
2	1	0	3	0	5	0	1	0	2	0	6	3	2	5	1	0	0	0	2	1	4	6	0	0	1	5	90	1	5	46.67	2.83	2.67	3	4	2.33	2.67	13.5
7	**1**	**14.5**	**10.5**	**1**	**22**	**0**	**13**	**0**	**17**	**5**	**29**	**10**	**13**	**25**	**9**	**4**	**2**	**4**	**12**	**6**	**21**	**33**	**8**	**4**	**6**	**30**	**87.9**	**14**	**19**	**47.21**	**2.53**	**2.46**	**3.06**	**3.5**	**1.92**	**2.47**	**12.44**
1	0	2	6	2	8	0	2	0	5	3	7	4	2	6	4	1	0	1	0	3	3	8	5	1	2	8	64.5	4	3	31.5	2.4	2.7	3	1.7	1.9	2.2	12.2
5	0	3	6	1	10	0	6	0	9	6	10	9	8	7	9	0	1	0	0	0	8	13	2	5	2	10	54.7	0	0	0	2.25	2	3.25	1.1	2	2.19	11.69
1	0	0	0	0	1	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	0	1	0	0	0	1	52.5	1	1	50	2.5	2	1.5	3	2	2	10
2	0	1	0.5	1.5	3	0	1	0	2	1	3	1	7	1	3	0	0	0	0	0	2	3	1	2	1	3	66.3	2	2	43.75	2	1.75	3.25	1.8	2	1.75	10.75
3	0	3	3	0	6	0	2	0	4	3	5	4	8	4	4	0	0	0	0	0	2	7	1	0	1	7	58.8	2	0	13.13	1.75	1.75	3.25	1.3	2	1.5	10.25
2	0	0	2	0	4	0	0	0	1	3	1	3	6	1	3	0	1	0	0	0	4	3	1	0	0	4	42.5	0	0	0	2	2	3.25	1	2.25	1.75	11.25
1	0	0	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	1	1	0	0	0	1	100	0	1	10	2	1	3	4	1	1	8
2.5	0	1	2.5	1	6	0	1	0	4	2	4	6	6	3	4	0	0	0	0	0	4	6	1	2	1	6	67.1	1	0	10.71	2.29	2.14	2.86	1.4	1.57	2	10.86
2	0	4	6	0	8	0	3	0	5	7	5	3	12	2	10	0	3	0	0	0	7	5	4	1	2	9	80.4	3	1	19.58	1.75	1.83	2.75	1.5	1.67	1.75	9.75
19.5	**0**	**14**	**26**	**5.5**	**47**	**0**	**15**	**0**	**31**	**25**	**37**	**30**	**52**	**24**	**39**	**2**	**5**	**1**	**0**	**4**	**31**	**47**	**15**	**11**	**9**	**49**	**65.2**	**13**	**8**	**19.85**	**2.1**	**1.91**	**2.9**	**1.9**	**1.82**	**1.79**	**10.53**
9.5	1	19.5	19	1	37	0	13	0	29	0	48	24	15	49	0	2	3	3	8	7	30	47	8	5	7	41	75.3	18	17	29.91	2.25	2.25	2.54	2.4	1.83	2.2	11.06
18	0	9	17.5	5.5	33	0	15	0	20	30	19	17	51	7	49	0	4	2	4	2	22	33	16	10	9	37	57.7	10	11	31.82	1.98	1.82	3.18	2.1	1.87	1.75	10.6
25	0	23	28.5	4.5	55	0	24	0	37	29	49	36	61	31	46	5	6	3	9	7	44	63	20	12	10	67	55.8	22	21	29.72	2.19	2.13	2.99	2.3	1.9	2.01	11.23
2.5	0	4.5	8	2	14	0	3	0	11	1	16	3	5	14	3	1	1	2	2	3	8	16	4	4	5	12	129	6	7	31.16	1.76	1.52	2.09	2.5	1.2	1.65	8.215
5.5	1	10.5	6	3	16	0	11	0	16	6	20	10	15	14	12	4	7	5	11	10	13	23	7	6	4	24	74.3	6	16	28.75	2.53	2.58	2.82	2.9	1.86	2.29	12.08
23	0	18	30.5	3.5	54	0	18	0	33	25	47	31	52	35	38	2	0	1	1	1	40	58	18	10	12	57	71.5	22	14	32.57	2.08	1.77	2.93	2.2	1.9	1.85	10.53
9.5	0	6	13	1.5	17	0	12	0	9	30	0	9	29	0	30	0	2	2	2	0	16	18	12	3	5	23	44.2	5	4	16.59	1.6	1.81	2.97	1.6	1.55	1.41	9.351
17	1	22.5	22.5	5	51	0	16	0	39	0	66	31	36	47	19	2	5	3	9	9	35	60	12	11	11	53	81	23	23	37.91	2.34	2.06	2.93	2.7	1.94	2.18	11.45
5	0	2	1	0	5	0	4	0	5	2	6	2	5.5	4	4	0	1	3	2	2	3	7	2	1	1	8	63.3	1	6	36.67	1.44	1.44	2	2.4	1.39	1.5	7.778
8	1	12.5	8.5	2	23	0	7	0	18	5	25	10	20	17	13	5	2	0	9	6	18	27	3	6	5	24	84.4	17	16	50.76	2.37	2.12	2.83	3.4	1.82	2.13	11.27
13	1	14.5	9.5	2	28	0	11	0	22	7	31	13	26	22	16	4	3	3	9	6	20	34	10	5	8	30	89.8	18	22	52.57	2.37	2.03	3.22	3.5	1.76	2.19	11.56
4	0	6	4	0	10	0	4	0	8	1	13	5	6	10	4	2	1	1	4	5	10	13	2	3	2	13	82.4	6	8	37.96	2.21	2.02	1.93	3	1.83	2.08	10.07
26.5	0	27.5	4.5	3.5	37	0	22	0	31	19	39	22	48	27	32	1	5	2	9	4	35	48	14	8	9	47	64	20	16	36.68	2.14	1.95	3.16	2.5	1.94	2.04	11.24
1	1	1	30.5	0.5	30	0	3	0	14	11	22	16	17	18	15	0	1	2	2	2	18	27	9	3	5	28	60.4	7	7	20.5	1.71	1.63	2.32	1.6	1.56	1.57	8.796

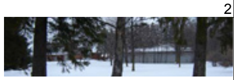
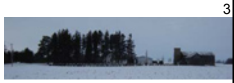
PHOTO	Property #	Farm	House	Farm Type						Typical Figures				Barn Construction																					House Construction											
	Bear Creek Road			chicken	horse	beef	dairy	grain	other	silo	fence	farmhouse	barn	stone	concrete	wood	steel	openings	red	green	yellow	white	brown	blue	steel	orange	signage	# total	# new	# old	pitch roof	gambrel roof	flat roof	round roof	brick	stone	wood siding	vinyl siding	red	green	yellow	white	brown	pitch roof	gambrel roof	hip roof
	1		1																																1				1					1		
	2		1																																			1				1		1		
	3	1		1								1	1		1		1					1						2	2		1				0.5			0.5	0.5			0.5		1		
	4	1						1		1		1	1		1	1							1					3	1	2	1							1				1		1		
	5	1																																	1						1					1
	6		1																																			1				1		1		
	7		1																																1				1					1		
	TOTALS	3	4	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	3.5	0	0	3.5	2.5	0	1	3.5	0	6	0	1
	FARM TOTALS	3	0	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	1.5	0	0	1.5	0.5	0	1	1.5	0	2	0	1
	RES TOTALS		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2	0	4	0	0
ORIGINAL FARMHOUSE		2	1	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	3	1	2	1	0	0	0	1	0	0	2	0	0	1	2	0	2	0	1
NEW RESIDENTIAL		1	3	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	2	2	0	1	0	0	0	2.5	0	0	1.5	2.5	0	0	1.5	0	4	0	0
LESS THAN 100 ft		2	4	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	2	2	0	1	0	0	0	3.5	0	0	2.5	2.5	0	1	2.5	0	5	0	1
DISTANCE FROM THE ROAD		1	0	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	3	1	2	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0
LAND USE VISABLE		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	1	0	0	1	0	1
NOT VISABLE		2	3	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	1.5	0	0	3.5	1.5	0	0	3.5	0	5	0	0
1 storey		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	2	0	0	1	0	3	0	0
2 storey		3	1	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	1.5	0	0	2.5	0.5	0	1	2.5	0	3	0	1
RED		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER COLOUR		2	0	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	0.5	0	0	1.5	0.5	0	0	1.5	0	2	0	0
STEEL BARN		1	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	2	2	0	1	0	0	0	0.5	0	0	0.5	0.5	0	0	0.5	0	1	0	0
WOOD BARN		1	0	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	3	1	2	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0
BRICK HOUSE		2	2	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	2	2	0	1	0	0	0	3.5	0	0	0.5	2.5	0	1	0.5	0	3	0	1
SIDED HOUSE		2	2	1	0	0	0	1	0	1	0	2	2	0	2	1	1	0	0	0	0	1	1	0	0	0	0	5	3	2	2	0	0	0	0.5	0	0	3.5	0.5	0	0	3.5	0	4	0	0

Fig8.66; Sample rating chart for Bear Creek Road.

flat roof	dormers	1 storey	2 storey	porch	garage	original farmhouse	new house	no house	**Land Use** kids area	tractors	animals	orchard/crop	**Vegitation** hedge rows	gerneral planting	finished' planting	water or other feature	private wall	accent property	**Community** distance from road (ft)	**Site Plan** distant	whole	measure	**INTAGELBLES (1-4 rating)** Placeness	Unity/Composition	Health	Variety/Complexity	welcoming	attractive	OVERALL	**Notes/ Comments** what is the character
		1		1	1		1						1		1			1	40				1	1	4	1	3	1	10	trying to be a suburban lot, closed in,
		1			2		1						1	1				1	60				2	2	3	1	2	2	11	
	1		1		1		1						1	1			1		50	1		100	3	1	4	4	1	2	11	nicely settled by the trees, very separte from barns, don't like front row of trees which diges the house and barns,
	1		1			1							1	1				1	150	1		50	2	2	2	4	2	2	10	barn is falling apart, tree line could continue to barn, new steel shed for what when you already have a barn
			1			1			1				1	1				1	50				3	3	2	1	2	3	13	very nice farmhouse, very secluded site,
			1	1	1	1							1	1				1	50				3	3	3	1	2	3	14	there is a lot of variety in the house and roof planes, nice tree lined lane, fence along road really helps the property, very treed in site
	1	1		1	2		1		1				1	1				1	20				2	2	3	1	2	1	10	plain, flat house, short trees,
0	**3**	**3**	**4**	**3**	**7**	**3**	**4**	**0**	**2**	**0**	**0**	**0**	**7**	**6**	**1**	**0**	**1**	**6**	**60**	**2**	**0**	**21.4286**	**2.2857143**	**2**	**3**	**1.857142857**	**2**	**2**	**11.285714**	
0	**2**	**0**	**3**	**0**	**1**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**3**	**3**	**0**	**0**	**1**	**2**	**83.33333333**	**2**	**0**	**50**	**2.6666667**	**2**	**2.667**	**3**	**1.6666667**	**2.333333**	**11.333333**	
0	**1**	**3**	**1**	**3**	**6**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**4**	**3**	**1**	**0**	**0**	**4**	**42.5**	**0**	**0**	**0**	**2**	**2**	**3.25**	**1**	**2.25**	**1.75**	**11.25**	
0	**1**	**0**	**3**	**1**	**1**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**3**	**3**	**0**	**0**	**0**	**3**	**83.33333333**	**1**	**0**	**16.6667**	**2.6666667**	**2.666666667**	**2.333**	**2**	**2**	**2.666667**	**12.333333**	
0	**2**	**3**	**1**	**2**	**6**	**0**	**4**	**0**	**1**	**0**	**0**	**0**	**4**	**3**	**1**	**0**	**1**	**3**	**42.5**	**1**	**0**	**25**	**2**	**1.5**	**3.5**	**1.75**	**2**	**1.5**	**10.5**	
0	**2**	**3**	**3**	**3**	**7**	**2**	**4**	**0**	**2**	**0**	**0**	**0**	**6**	**5**	**1**	**0**	**1**	**5**	**45**	**1**	**0**	**16.6667**	**2.3333333**	**2**	**3.167**	**1.5**	**2**	**2**	**11.5**	
0	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**150**	**1**	**0**	**50**	**2**	**2**	**2**	**4**	**2**	**2**	**10**	
0	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**0**	**2**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**2**	**35**	**0**	**0**	**0**	**2.5**	**2.5**	**2.5**	**1**	**2**	**2**	**11.5**	
0	**2**	**2**	**3**	**2**	**5**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**5**	**4**	**1**	**0**	**1**	**4**	**70**	**2**	**0**	**30**	**2.2**	**1.8**	**3.2**	**2.2**	**2**	**2**	**11.2**	
0	**1**	**3**	**0**	**2**	**5**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**3**	**2**	**1**	**0**	**0**	**3**	**40**	**0**	**0**	**0**	**1.6666667**	**1.666666667**	**3.333**	**1**	**2.3333333**	**1.333333**	**10.333333**	
0	**2**	**0**	**4**	**1**	**2**	**3**	**1**	**0**	**1**	**0**	**0**	**0**	**4**	**4**	**0**	**0**	**1**	**3**	**75**	**2**	**0**	**37.5**	**2.75**	**2.25**	**2.75**	**2.5**	**1.75**	**2.5**	**12**	
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
0	**2**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**1**	**1**	**100**	**2**	**0**	**75**	**2.5**	**1.5**	**3**	**4**	**1.5**	**2**	**10.5**	
0	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**50**	**1**	**0**	**100**	**3**	**1**	**4**	**4**	**1**	**2**	**11**	
0	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**150**	**1**	**0**	**50**	**2**	**2**	**2**	**4**	**2**	**2**	**10**	
0	**2**	**2**	**2**	**2**	**4**	**1**	**3**	**0**	**2**	**0**	**0**	**0**	**4**	**3**	**1**	**0**	**1**	**3**	**40**	**1**	**0**	**25**	**2.25**	**1.75**	**3.25**	**1.75**	**2**	**1.75**	**11**	
0	**2**	**1**	**3**	**1**	**4**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**4**	**4**	**0**	**0**	**1**	**3**	**77.5**	**2**	**0**	**37.5**	**2.5**	**2**	**3**	**2.5**	**1.75**	**2.25**	**11.5**	

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